# THE SOCIETY OF UNIVERSITY NEUROSURGEONS

Cape Town/Johannesburg, South Africa

## 2017 ANNUAL MEETING

July 27-31/August 1-3, 2017

THE SOCIETY OF UNIVERSITY NEUROSURGEONS


American Association of Neurological Surgeons

Jointly Provided by the AANS

# South Africa 2017
## Cape Town/ Pilanesberg National Park

For some a visit to Africa will be an once in a lifetime experience, for others it will be just another stop on the ever enchanting global SUN itinerary. Either way, the program for the 2017 SUN meeting should whet your appetite. Together with the University of Cape Town, we are delighted to welcome SUN members for our very first meeting on African soil. Africa is acknowledged as the cradle of humankind, the birthplace of our ancestors. We are sure that South Africa will offer you a meeting that celebrates our shared legacy while reflecting the different challenges we face in our modern lives.

In addition to an exciting Scientific Program, which will offer an African perspective on Neurosurgery within the global context, there will be ample opportunity to plan an exceptional and memorable trip on either side of the meeting.

Recently named the best destination in the world to visit by both the New York Times and The Telegraph, Cape Town is without doubt one of the most scenic cities in the world. Steeped in history, this vibrant cosmopolitan city lies wedged between the mountains and the seas. There is no shortage of sightseeing, leisure and sporting activities on offer, from the tranquil to the extreme. Must-see's include Cape Point - the most Southern tip of Africa where the Indian and Atlantic oceans meet, conquering Table Mountain, (either by cable car or following one of the hiking trails) and of course the pièce de résistance, the famed Cape Winelands. We will celebrate our medical history with a visit to Groote Schuur Hospital where the first human heart transplant took place and the CT scanner was invented by Nobel Laureate, Alan Cormack. A ferry crossing will take us on a visit to Robben Island, where late President Nelson Mandela was incarcerated for 18 years.

Moving north from Cape Town, July is the best time of year to visit the country's game reserves. The second half of the meeting will take place in the Pilanesberg National Park amongst Africa's Big 5. Along the way we will reflect over lunch on the journey of man at the Cradle of Humankind / Maropeng World Heritage Site.

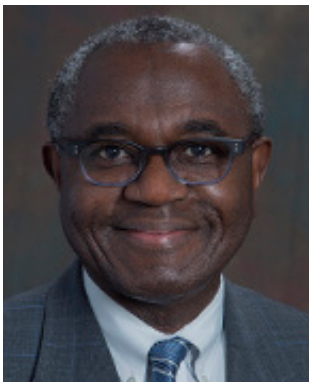
We look forward to sharing this journey with you.

Warm Regards,

**Graham Fieggen, MD**
Local Host, SUN 2017
University of Cape Town

**Nelson M. Oyesiku, MD, PhD, FACS**
President, SUN 2016-2017
Emory University

**Graham Fieggen, MD**
Local Host



**Nelson M. Oyesiku, MD, PhD, FACS**
Co-Host

## Present Officers

**President**
Nelson Oyesiku

**President-Elect**
Michael Wang

**Vice President**
Rich Ellenbogen

**Secretary/Treasurer**
Felipe Albuquerque

**Member-at-large**
Madison Michael

**Historian**
Ken Smith

**Membership Committee**
Erol Veznedaroglu
Rich Anderson
Feridu Acar

**Future Site Committee**
(Officer) Michael Kaiser
Anthony Sin
Jeff Sorenson

# Previous Meetings

~~~~~~1965~~~~~~
Montreal Neurological Institute
Montreal, QUE
~~~~~~1966~~~~~~
Duke University
Durham, NC
~~~~~~1967~~~~~~
University of Minnesota
Minneapolis, MN
~~~~~~1968~~~~~~
Upstate Medical Center
Syracuse, NY
~~~~~~1969~~~~~~
Massachusetts General Hospital
Boston, MA
~~~~~~1970~~~~~~
Baptist Memorial Hospital
Memphis, TN
~~~~~~1971~~~~~~
Albert Einstein College of Medicine
Bronx, NY
~~~~~~1972~~~~~~
University of British Columbia
Vancouver, BC
~~~~~~1973~~~~~~
Emory University
Atlanta, GA
~~~~~~1974~~~~~~
University of Texas Medical School
San Antonio, TX
~~~~~~1975~~~~~~
Mayo Clinic
Rochester, MN
~~~~~~1976~~~~~~
Jefferson Medical College
Philadelphia, PA
~~~~~~1977~~~~~~
Mayfield Neurological Institute
Cincinnati, OH
~~~~~~1975~~~~~~
Mayo Clinic
Rochester, MN
~~~~~~1976~~~~~~
Jefferson Medical College
Philadelphia, PA
~~~~~~1977~~~~~~
Mayfield Neurological Institute
Cincinnati, OH
~~~~~~1978~~~~~~
Medical College of Georgia
Augusta, GA
~~~~~~1979~~~~~~
University of Guadalajara
Guadalajara, MX
~~~~~~1980~~~~~~
University of Florida
Gainesville, FL
~~~~~~1981~~~~~~
University of Western Ontario
London, ONT
~~~~~~1982~~~~~~
University of Mississippi
Jackson, MS
~~~~~~1983~~~~~~
Duke University/University of NC
Durham/Chapel Hill, NC
~~~~~~1984~~~~~~
University of Washington
Seattle, WA
~~~~~~1985~~~~~~
University of Colorado
Denver/Vail, CO
~~~~~~1986~~~~~~
University of Louisville
Louisville, KY
~~~~~~1987~~~~~~
Medical College of Virginia
Richmond, VA
~~~~~~1988~~~~~~
University of Tubingen
Tubingen, FRG
~~~~~~1989~~~~~~
University of Toronto
Toronto, ONT
~~~~~~1990~~~~~~
Louisiana State Univ. Medical Center
New Orleans, LA
~~~~~~1991~~~~~~
Tufts New England Medical School
Boston, MA
~~~~~~1992~~~~~~
Dartmouth Medical School
Woodstock, VT
~~~~~~1993~~~~~~
St. Louis University Medical School
St. Louis, MO
~~~~~~1994~~~~~~
University of Lyon
Lyon, France
~~~~~~1995~~~~~~
Thomas Jefferson Medical School
Philadelphia, PA
~~~~~~1996~~~~~~
University of Southern California
Los Angeles, CA
~~~~~~1997~~~~~~
University of Michigan
Ann Arbor, MI
~~~~~~1998~~~~~~
University of Tennessee
Memphis, TN
~~~~~~1999~~~~~~
University of Melbourne
Melbourne, Australia
~~~~~~2000~~~~~~
Havard Medical School/
Brigham & Women's
Boston, MA
~~~~~~2001~~~~~~
Oregon Health Sciences University
Portland, OR
~~~~~~2002~~~~~~
Northwestern University/ Chicago
Evanston, IL
~~~~~~2003~~~~~~
Columbia Presby. Med Center/
NY Presby. Hospital
New York, NY
~~~~~~2004~~~~~~
Karolinska Institute
Stockholm, Sweden
~~~~~~2005~~~~~~
Wake Forest University
School of Medicine
Winston-Salem, NC
~~~~~~2006~~~~~~
University of California – San Diego
Del Mar, CA
~~~~~~2007~~~~~~
National Hospital for Neurology
and Neurosurgery
London, England
~~~~~~2008~~~~~~
University of California
San Francisco, CA
~~~~~~2009~~~~~~
Sapienza University
Rome, Naples & Capri, Italy
~~~~~~2010~~~~~~
University of Miami
Miami, Florida
~~~~~~2011~~~~~~
Istanbul, Turkey
~~~~~~2012~~~~~~
Emory University
Atlanta, Georgia
~~~~~~2013~~~~~~
Carlos Haya University
Malaga, Spain
~~~~~~2014~~~~~~
University of Washington
Seattle, WA
~~~~~~2015~~~~~~
Huashan Hospital Fudan University
Shanghai, China
~~~~~~2016~~~~~~
Barrow Neurological Institute
Phoenix, AZ
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# Past Presidents

~~~~~~1965~~~~~~
James T. Robertson, MD

~~~~~~1966~~~~~~
George T. Tindall, MD

~~~~~~1967~~~~~~
Robert G. Ojemann, MD

~~~~~~1968~~~~~~
Charles L. Branch, MD

~~~~~~1969~~~~~~
Jim Story, MD

~~~~~~1970~~~~~~
Herbert Lourie, MD

~~~~~~1971~~~~~~
Byron Pevehouse, MD

~~~~~~1972~~~~~~
Kenneth Shulmann, MD

~~~~~~1973~~~~~~
Darton Brown, MD

~~~~~~1974~~~~~~
Ellis Keener, MD

~~~~~~1975~~~~~~
Robert Hardy, MD

~~~~~~1976~~~~~~
Phanor Perot, MD

~~~~~~1977~~~~~~
Gordon Thompson, MD

~~~~~~1978~~~~~~
Lucien R. Hodges, MD

~~~~~~1979~~~~~~
Robert White, MD

~~~~~~1980~~~~~~
Robert Grossman, MD

~~~~~~1981~~~~~~
Stewart Dunsker, MD

~~~~~~1982~~~~~~
Marshall Allen, MD

~~~~~~1983~~~~~~
Ian Turnbull, MD

~~~~~~1984~~~~~~
Henry Garretson, MD

~~~~~~1985~~~~~~
Harold F. Young, MD

~~~~~~1986~~~~~~
Robert Smith, MD

~~~~~~1987~~~~~~
Kenneth R. Smith, Jr. MD

~~~~~~1988~~~~~~
Willis Brown, MD

~~~~~~1989~~~~~~
Glenn W. Kindt, MD

~~~~~~1990~~~~~~
Salvador Gonzales-Cornejo, MD

~~~~~~1991~~~~~~
Michael L.J. Apuzzo, MD

~~~~~~1992~~~~~~
William A. Buchheit, MD

~~~~~~1993~~~~~~
Alan R. Hudson, MD

~~~~~~1994~~~~~~
Robert Maxwell, MD

~~~~~~1995~~~~~~
Peter L. Black, MD

~~~~~~1996~~~~~~
William Shucart, MD

~~~~~~1997~~~~~~
Ronald F. Young, MD

~~~~~~1998~~~~~~
David W. Roberts, MD

~~~~~~1999~~~~~~
Charles S. Hodge, Jr. MD

~~~~~~2000~~~~~~
John E. McGillicuddy, MD

~~~~~~2001~~~~~~
H. Hunt Batjer, MD

~~~~~~2002~~~~~~
Philip Stieg, PhD, MD

~~~~~~2003~~~~~~
Robert Rosenwasser, MD

~~~~~~2004~~~~~~
Robert Breeze, MD

~~~~~~2005~~~~~~
Kim Burchiel, MD

~~~~~~2006~~~~~~
Jon Robertson, MD

~~~~~~2007~~~~~~
Carl Heilman, MD

~~~~~~2008~~~~~~
Robert Solomon, MD

~~~~~~2009~~~~~~
Jeffrey Bruce, MD

~~~~~~2010~~~~~~
John Wilson, MD

~~~~~~2011~~~~~~
Anil Nanda, MD

~~~~~~2012~~~~~~
Thomas Origitano, MD

~~~~~~2013~~~~~~
Neil Kitchen, MD

~~~~~~2014~~~~~~
Sander Connolly, MD

~~~~~~2015~~~~~~
Jacques Morcos, MD

~~~~~~2016~~~~~~
Michael Levy, MD

# 2017 Meeting Attendees

## SUN Members

Adelson, David P., MD
Albuquerque, Felipe, MD
Anderson, Richard, MD
Barrow, Dan, MD
Boulis, Nicholas, MD
Brau, Ricardo, MD
Bristol, Ruth, MD
Bruce, Jeffrey, MD
Connolly, Sander, MD
Ecklund, James, MD
Ellenbogen, Richard, MD
Erkmen, Kadir, MD
Fieggen, Graham, MD (Host)
Heilman, Carl, MD
Kaiser, Michael, MD
Kitchen, Neil, MD
Lavine, Sean, MD
Liebman, Kenneth, MD
Levy, Michael, MD
Liu, Charles, MD
Markert, James, MD
McCutcheon, Ian, MD
McKhann, Guy, MD
Michael, Madison, MD
Morcos, Jacques, MD
Narayan, Raj, MD
Nanda, Anil, MD
Notarianni, Christina, MD
Ogden, Alfred, MD
Oyesiku, Nelson, MD (Host)
Patel, Aman, MD
Rosen, Charles, MD
Sin, Anthony, MD
Sisti, Michael, MD
Smith, Kenneth, MD
Solaroglu, İhsan, MD
Sorrenson, Jeffrey, MD
Tibbs, Phillip, MD
Tronnier, Volker , MD
Varsos, Georgios, MD
Veznedaroglu, Erol, MD
Wang, Michael, MD
Yoshor, Daniel, MD

## Members' Guests

**Britz, Gavin, MD**
**Schulder, Michael, MD**
**Sloan, Andrew, MD**
**Van Der Veer, Craig, MD**
**van Loveren, Harry, MD**
(Oyesiku, Nelson, MD)

**Binning, Mandy, MD**
(Veznedaroglu, Erol, MD)

**Brown, Benjamin, MD**
**Cardenas, Raul, MD**
**Shah, Mitesh, MD**
**Zager, Eric, MD**
**Patel, Sunil,MD**
(Nanda, Anil, MD)

**Curry, William, MD**
(Ogden, Alfred, MD)

**Charbel, Fady, MD**
**Lang, Frederick, MD**
**Levi, Allan, MD, Ph.D.**
(Morcos, Jacques, MD)

**Prabhu, Sujit, MD**
(McCutcheon, Ian, MD)

**Sheth, Sameer, MD**
(Anderson, Richard, MD)

**Wirt, Timothy, MD**
(Breeze, Robert, MD)

**Krieger, Mark, MD**
(Levy, Mike, MD)

**Kurpad, Shekar, MD**
(Wang, Michael, MD)

**Nahed, Brian, MD**
**Crockroft, Kevin, MD**
(Bruce, Jeffrey, MD)

# Distinguished Service Award

## Carl Heilman, MD

Carl Heilman MD is the Neurosurgeon-in-Chief at Tufts Medical Center. He is a Professor and the Chairman of the Department of Neurosurgery. Internationally renowned for neurosurgical excellence, Dr. Heilman specializes in surgery for skull base tumors, pituitary tumors, meningiomas, schwannomas and Chiari 1 malformations. He has served as the President of the North American Skull Base Surgery Society, the Society of University Neurosurgeons, the Boston Society of Neurology and Psychiatry, and the New England Neurosurgical Society.

# Special Speaker

## Kingsley Holgate

Born under African skies from a missionary family Kingsley's adventures started at a young age. Countless hours spent on his father's lap, he was enthralled by stories of the great Victorian explorers. This soon led to many missionary journeys with his parents far into the wilds of Africa and even the old Belgium Congo and was to plant the seed for Kingsley's own epic journeys of discovery.

No other group of adventurers have in a single journey traversed the entire outline of the African continent through 33 countries; completed a South to North journey from the Cape of Good Hope to Alexandria and the mouth of the Nile, followed an East to West crossing along the Zambezi and Congo Rivers in the footsteps of early explorers Livingstone and Stanley, and then a series of unique world first wild journeys that allowed the Kingsley Holgate Africa Foundation backed expedition team to embrace every country on the African continent to include her island states.

But after countless expeditions it was time to give something back to the people of Mama Africa. For Kingsley and his team it was about finding a cause close to their hearts and truly making a difference to the lives of so many rural Africans. And so the Kingsley Holgate Foundation was formed with the humanitarian initiates of malaria prevention, water purification and Rite to Sight spectacles for the poor sighted.

# Welcome to Houston for SUN 2018

As lead organizer of SUN 2018, which will be held in Houston on March 22-25, I invite you to join us for what promises to be an outstanding meeting in the Bayou City. The weather in March is the best of the year, avoiding the chills of winter and the humid heat of summer, and we have planned a comfortable and elegant venue, an introduction to the host program (M D Anderson) assisted by our partners at Baylor, and interesting speakers and cultural and social activities. Houston is America's fourth largest city, and contains a population that is as diverse as it is welcoming. The meeting is tentatively scheduled to be held at the Hotel Zaza in the Museum District, adjacent to Rice University, Hermann Park with its outstanding zoo and golf course, multiple museums, and of course, the Texas Medical Center where both M D Anderson and Baylor proudly reside. The variety and richness of Houston is vast: it is the home of Beyonce, petrochemical plants, 26 Fortune 500 companies, America's astronaut corps, fine neighborhoods, major league sports teams, the biggest concentration of medical expertise on the planet, the world's first domed stadium (the Astrodome, still standing), theater and music of every genre, shopping that yields objects of desire at every level, and thousands of restaurants to suit all gastronomic tastes. As the town that was named after Sam Houston, that sent Neil Armstrong to the moon (where "Houston" was the word first spoken from the lunar surface), where air conditioning was invented, it has a colorful history that peeps out at you in unexpected places. This mix of economic power, intellectual heft, and cultural diversity is the only major city in the US without zoning, and it has the busiest port in the nation for foreign tonnage despite not being technically on the ocean. It is the most ethnically diverse major city in America, and it contains some of the nicest, most welcoming people you will meet anywhere. Please come take part in a SUN meeting where old friends will come together, new friends will be made, and where we will learn from each other while enjoying the quirkiness, elegance, and unexpected beauty you will find in Houston, a city like no other.

Ian McCutcheon, MD
Professor, Department of Neurosurgery
Division of Surgery, UT MD Anderson Cancer Center, Houston, TX

THE SOCIETY OF UNIVERSITY NEUROSURGEONS

# Meeting Schedule

## Thursday, July 27, 2017

| | | |
|---|---|---|
| 6:00-8:30 pm: | Welcome Reception | Atlantic Room<br>Table Bay Hotel |

## Friday, July 28, 2017

| | | |
|---|---|---|
| 6:30-11:00 am: | Breakfast | |
| **7:00-7:30 am:** | **Executive Committee Meeting** | |
| 8:30-12:25 pm: | Scientific Session | University of Cape Town<br>Wolfson Pavilion, UCT<br>Medical School |
| | Moderator: | Fieggen, Graham, MD |
| 8:30-8:35 am: | Welcome | Oyesiku, Nelson, MD (Emory) |
| 8:35-8:50 am: | Medicine in South Africa: the next generation. | Mayosi, Bongani, MD , DPhil (UCT) |
| 8:50-9:05 am: | Neurosurgery at UCT | Fieggen, Graham, MD |
| 9:05-9:20 am: | Changing the paradigm of TBI treatment in the age of precision medicine. | Figaji, Tony, MD, PhD (UCT) |
| 9:20-9:35 am: | Intensive Care Management Following Pediatric TBI in Environments with Variable Resources. | Adelson, David , MD (BNI) |
| 9:35-9:50 am: | Who should look after critically ill neurosurgical patients? | Semple, Patrick, MD, PhD (UCT) |
| 9:50-10:05 am: | New insights into CNS Tuberculosis. | Rohlwink, Ursula, MD, PhD (UCT) |
| 10:05-10:20 am: | UCT's contribution to vaccine development. | Hussey Greg, MD (UCT) |
| 10:20-10:40 am: | Break | |
| 10:40-10:55 am: | Big Data Research in Neurosurgery: A Critical Look at this Popular New Study Design | Michael, Madison, MD |
| 10:55-11:10 am: | Structural and functional assessment of the visual pathway: from pupil to visual cortex | Padayachy, Llewellyn, MD, PhD (Oxford/UCT) |
| 11:10-11:25 am: | Neuro-intervention for cerebrovascular disorders | Feuvre Le, David, MD (UCT) |

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|---|---|---|
| 11:25-11:40 am: | Surgery for spasticity | Enslin, Nico, MD (UCT) |
| 11:40-11:55 am: | The controversial history of psychosurgery: what impact does our past have on our future? | Schulder, Michael, MD (North Shore) |
| 11:55-12:10 pm: | Current Oncolytic Viral trials in Glioma | Markert, James, MD (UAB) |
| 12:10-12:25 pm: | Allan Cormack: CT pioneer. | Vaughan, Kit, MD, PhD (Cape Ray) |
| 12:30-1:30 pm: | Lunch | Tafelberg Room, Groote Schuur Hospital |
| 1:30 pm: | The first human heart transplant: | Heart of Cape Town Museum |

## Attendees and Accompanying Guests

1:00-2:00 pm: Heart Museum
7:30 pm: Dinner V&A Waterfront

## Spouses/Children

11:00-1:00 pm: Heart Museum (Optional)

Return shuttle transfers to Table Bay Hotel
7.30 pm: Dinner at V&A Waterfront

## Available options include:

Tour of Cape Town – places of interest and historical sights

## Saturday, July 29, 2017

6:30-11:00 am: Breakfast

8:30 am: Buses leave
9:30-12:00 pm: Scientific Session — Stellenbosch University

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|---|---|---|
| 9:30-10:30 am: | The University of Stellenbosch. How do we learn from our experience, grow and move forward together? . | de Villiers, Wim, MD, PhD (Rector) |
| 10:30-11:00 am: | Break | |
| 11:00-11:30 pm: | Social Impact and Transformation | van Rooi, Leslie, MD |
| 11:30-12:00 pm: | Campus Walkabout | |

## Attendees and Accompanying Guests

Lunch at Solms Delta Wine Farm
Evening at Leisure

## Sunday, July 30, 2017

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|---|---|---|
| 6:30-11:00 am: | Breakfast | |
| 6:30-7:30 am: | Business meeting/Breakfast | Pavilion Room |
| 7:30-11:40 am: | Scientific Session | Pavilion Room |
| 7:30-10:10 am: | Moderator: | Veznedaroglu, Erol, MD |
| 7:30-7:45 am: | Physician Leadership in the Era of Precision Neurosciences. | Ecklund, James, MD |
| 7:45-8:00 am: | Blood based test for brain tumors. | Nahed, Brian, MD |
| 8:00-8:15 am: | Correlates of facial nerve outcomes after acoustic neuroma surgery: Results of a consecutive series at a tertiary care center. | Morcos, Jacques, MD |
| 8:15-8:30 am: | Relief of intractable nausea after resection of hemangioblastoma of the distal medulla in patients with von Hippel-Lindau disease: a clinical series. | McCutcheon, Ian, MD |
| 8:30-8:45 am: | Limbic System Surgery for Psychiatric Disorders: A “Precision Medicine” Approach | Sheth, Sameer, MD |
| 8:45-9:00 am: | The Changing Face of Epilepsy Surgery: New Approaches to Old Problems | Mckhann, Guy, MD |
| 9:00-9:15 am: | Tales from the Veld: Churchill, Gandhi and Smuts. | Nanda, Anil, MD |
| 9:15-9:25 am: | Presidential introduction | Barrow, Dan, MD |
| 9:25-10:10 am: | Presidential Lecture<br>African Chronicles: scramble, colonization, decolonization, misrule and resurgens | Oyesiku, Nelson, MD |
| 10:10-10:40 am | Break with exhibitors | |
| 10:40-11:40 am: | Moderator: | Erkmen, Kadir, MD |
| 10:40-10:55 am: | The impact of surgery on survival after progression of glioblastoma: a contemporary analysis | Curry, William, MD |
| 10:55-11:10 am: | Model of Cerebral Ischemia and Potential treatment | Rosen, Charles, MD |
| 11:10-11:25 am: | Instrumenting long and fusing short in young children undergoing occipital-cervical-thoracic stabilization: Technical note and case series | Anderson, Richard, MD |

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| 11:25-11:40 am: | Recent UK medicolegal changes in consent procedure - implications for neurosurgery | Kitchen, Neil, MD |
| 12:00 pm: | Depart for tours *optional at guest expense | |

## Attendees and Accompanying Guests

7:00 pm: Gala Dinner at The Table Bay Hotel ***Black Tie Optional**

## Monday, July 31, 2017

**Travel Day**

**Delegates will be requested to settle their extras account with the hotel on Sunday evening to alleviate delays etc on Monday morning.**

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| 6:30-11:00 am: | Breakfast |
| 6:00 am: | Hotel departure to airport |
| 8:30 am: | Flight departure |
| | Arrival Lanseria Airport – Meet & Greet - Transfer to Cradle of Humankind - Maropeng - Tour and lunch |
| 7:00 pm: | Dinner at the lodge |

## Tuesday, August 1, 2017

| | | |
|---|---|---|
| 6:30-9:30 am: | Early Morning Game Drive for the group to start off the day. | |
| 9:30-10:00 am: | Breakfast | |
| 10:00-12:45 pm: | Scientific Session | |
| 10:00-11:45 am: | Moderator: | Chin, Lawrence, MD |
| 10:00-10:15 am: | Imaging biomarkers for Spinal Cord Disease: a surgical perspective | Kurpad, Shekar, MD |
| 10:15-10:30 am: | MSC-Derived Exosomes Carrying microRNAs in the Treatment of Human Gliomas. | Lang, Fredrick, MD |
| 10:30-10:30 am: | Critical evaluation of Stroke Alert protocol- time for change. | Liebman, Ken, MD |

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| 10:45-11:00 am: | Proof of Concept: Robotic Sympathectomy. | Erkmen, Cherie, MD |
| 11:00-11:15 am: | Analysis of 3,298 Consecutive Neurosurgical Cases Demonstrates that Overlapping Surgery Has No Adverse Effect on Patient Outcome. | Barrow, Dan, MD |
| 11:15-11:30 am: | A 2-year old with a self-inflicted gunshot wound to the head: Patterns in pediatric cranial ballistic injuries. | Bristol, Ruth, MD |
| 11:30-11:45 am: | Break with exhibitors | |
| 11:45-12:45 pm: | Moderator: | Ecklund, James, MD |
| 11:45-12:00 pm: | Functional Outcome in Patients with Aneurysmal Subarachnoid Hemorrhage. | Brown, Ben, MD |
| 12:00-12:15 pm: | Relationship between aneurysm size and distal cerebral hemodynamics. | Charbel, Fady, MD |
| 12:15-12:30 pm: | Efficacy and outcomes of facial nerve–sparing treatment approach to cerebellopontine angle meningiomas | Sisti, Michael, MD |
| 12:30-12:45 pm: | Single-institution's experience using the extended middle fossa rhomboid approach for the safe resection of hemorrhagic cavernomas involving the lateral pons. | Levy, Mike, MD |

## Attendees and Accompanying Guests

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| 1:00 pm: | Golfers depart for the Lost City Golf Course, Sun City |
| 3:00 pm: | Game drive departure |
| | Afternoon tea and game drive for the group |
| 7:00 pm: | Dinner |

## Wednesday, August 2, 2017

| | | |
|---|---|---|
| 6:30-9:30 am: | Early Morning Game Drive for the group to start off the day. | |
| 9:30-10:00 am: | Breakfast | |
| 10:00-1:15 pm: | Scientific Session | |
| 10:00-11:30 am: | Moderator: | Levy, Mike, MD |
| 10:00-10:15 am: | Development of Intrathecal Riluzole: A new route of administration for the treatment of ALS patients | Boulis, Nicholas, MD |
| 10:15-10:30 am: | Emerging safety of intramedullary transplantation of human neural stem cells in cervical and thoracic spinal cord injury. | Levi, Allan, MD, PhD |
| 10:30-10:45 am: | Hematopoetic Progenitor Cells (HPC) Facilitate Bone Marrow Chemoprotection enabling TMZ/O6BG Dose Escalation resulting in Improved Survival. | Sloan, Andrew, MD |
| 10:45-11:00 am: | External Ventricular Drain Placement in the Angiography Suite Using Real Time Cone Beam CT Navigation. | Erkman, Kadir, MD |
| 11:00-11:15 am: | Role of brain hemostatic system in cerebrospinal fluid abnormalities following subarachnoid hemorrhage. | Britz, Gavin, MD |
| 11:15-11:30 am: | Break with exhibitors | |
| 11:45-1:15 pm: | Moderator: | Wang, Mike, MD |
| 11:45-12:00 pm: | DRG-Stimulation for the Treatment of Chronic Neuropathic Pain. | Tronnier, Volker |
| 11:45-12:00 pm: | VariLift-2 An anatomical solution to Lumbar Instability. | Tibbs, Phillip, MD |
| 12:00-12:15 pm: | Single-institution Experience with a Novel Parafascicular Intracerebral Hematoma Evacuation Procedure. | Shah, Mitesh, MD |
| 12:15-12:30 pm: | We've Got your Back: How the Nerve Surgeon Can Bail Out the Spine Surgeon. | Zager, Eric, MD |
| 12:30-12:45 pm: | Comparison of pedicle screw types used in pediatric deformity. | Sin, Anthony, MD |

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| 12:45-1:00 pm: | Degenerative Discharthropathy and Lumbar Stenosis with the Use of Interspinous Distractors. | Varsos, Vasileios, MD |
| 1:00-1:15 pm: | Diagnostic Cerebral Angiography for the evaluation of carotid stenosis prior to treatment. | Binning, Mandy, MD |
| 1:15-1:30 pm: | Predictors of local control of post-stereotactic radiosurgery brain lesions treated with laser interstitial thermal ablation | Prabhu, Sujit, MD |

## Attendees and Accompanying Guests

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|---|---|
| | Afternoon at leisure – activities |
| 3:00 pm: | Afternoon Tea & Game Drive |
| 7:00 pm: | Dinner |

## Thursday, August 3, 2017

Depending on group requirements and departure times we will offer an early morning game drive, breakfast and departure.

Delegates involved in the SNSA Congress Durban to depart early morning.
Group transfers arranged as per flight schedules

For late departures, we could offer a visit to Sun City (for own cost) – great for families and much to see and do (luggage to be stored in the vehicles at Sun City)
Should a day room for delegates be required, we could arrange this also.

Transfer time to OR Tambo Airport plus required check in time to be considered for delegates
Ivory Tree Game Lodge – OR Tambo International Airport, Johannesburg (3 hours transfer plus international 2 hour check in time)

Ivory Tree Game Lodge – Lanseria Airport (2 hour transfer plus 1 hour check in time)

## Learning Objectives

Upon completion of this CME activity, the participant should be able to:

- Discuss current practice patterns with regards to the symptomatology, diagnosis, treatment methods and complication avoidance with respect to the entire spectrum of neurosurgical conditions and allied specialties in the clinical and basic neurosciences.
- Review real clinical cases and specific treat ment methods that are justified and explained by recognized world leaders in the field.
- Describe the most recent and future trends in neurosurgery around the world.
- Identify effective program innovations and models from experts around the world.

## Accreditation/ Continuing Medical Education (CME)

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## Educational Format

Didactic lectures, case presentations/discussions, panel discussions, and oral paper presentations

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| Name | Disclosure | Type of Relationship* |
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| Levi, Allan, MD | Department of Defense | University Grants/Research Support |
| | Medtronic | Consultant Fee |
| Sloan, Adrew, MD | Ohio Wright Center for Stem Cell and Regenerative Medicine (CSCRM) Research Commercialization Program (RCP) (Gerson S, PI) 07/01/09 – 06/30/11 0.60 calendar Role: PI of clinical trial | University Grants/Research Support |
| | State of Ohio Third Frontier, $500,000 Project 4: Gene Therapy Approaches for Optimizing Glioma Treatment. The goal of this grant is to perform a GMP Phase I trial of Stem Cell Gene Therapy for patients with newly diagnosed GBM. Role: PI of project 4 (clinical trial) | University Grants/Research Support |
| | STTR R42CA128269-01A2 (Gerson S, PI) 09/03/10 – 08/31/12, 0.60-1.20 calendar NIH/NCI, $2,652,661 Lentiviral-MGMT gene transfer into Hematopoetic Stem Cells. The goal of this grant is to perform a GMP Phase I trial of Stem Cell Gene Therapy for patients with newly diagnosed GBM. Role: PI of Clinical Trial | University Grants/Research Support |
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Erkmen, Cherie, MD
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Vale, Fernando, MD
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Rohlwink, Ursula, MD
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# Abstracts

**Intensive Care Management Following Pediatric TBI in Environments with Variable Resources**

Jorge I. Arango, Raul Echeverri, Laeth George, Lucia Mirea, Andres Rubiano, P. David Adelson.
Barrow Neurological Institute at Phoenix Children's Hospital, University of Arizona College of Medicine-Phoenix, Arizona and Fundacion Meditech, Neiva University Hospital, Neiva, Colombia

***Adelson, David, MD***

**Introduction:**
Traumatic Brain Injury (TBI) is a global public health issue with over 10 million events serious enough to result in death or hospitalization occurring every year. The relevance of close monitoring and timely intervention has been repeatedly evidenced to improve survival and functional outcomes in individuals sustaining moderate to severe TBI. Frequently, the establishment of these is dependent on national and even institutional resources as well as on overall public health environments. Barrow Neurological Institute at Phoenix Children's Hospital (BPCH), USA and the University Hospital in Neiva (NUH), Colombia worked collaboratively to compare the management and outcomes of pediatric patients with severe TBI over a 5-year period.

**Methods:**
Retrospective chart reviews identified children 0 to 17 years old admitted to BPCH and NUH, with severe TBI, or moderate TBI and rapid deterioration within the first 24 hours post injury. Data collected included demographics, Glasgow Coma Scores (GCS), pre- and post-admission management, intensive care unit (ICU) monitoring, and Glasgow Outcome Scores (GOS). Comparisons between institutions employed the Pearson Chi-square, Fisher exact, T-test or Wilcoxon-rank sum test, as appropriate.

**Results:**
A total of 101 (66 BPCH and 35 NUH) subjects were identified meeting inclusion criteria. Age and gender distribution were relatively homogeneous (p 0.258 and 0.139 respectively) as it was injury severity as determined by admission GCS (μ 5 SD + 2). Cause and mechanism of injury were variable between institutions (p 0.000 and 0.004) and roughly 70% (68% BPCH, 71% NUH) of patients presented with multisystem trauma. Time from injury to arrival at the treating hospital was significantly different (p 0.025). The identification of radiological abnormalities significantly differed between institutions with subdural hemorrhages (p 0.001), diffuse axonal injuries (p 0.002) and intra-ventricular hemorrhages (p 0.004) showing the strongest elements driving such difference. Pharmaceutical intracranial pressure (ICP) management was significantly higher in the NUH population (p 0.004) though there was an overall lack of invasive monitoring compared to BPCH (45/66 vs. 5/35; p 0.000). The use of surgical decompression and subdural evacuation were significantly higher at BPCH (p 0.031and 0.003), while the use of epidural and intraparenchymal evacuations were roughly the same between institutions. Overall mortality rates were similar among institutions (15 % BPCH, 17% NUH) as well as functional outcomes with low to moderate disability (52% BPCH, 54% NUH). Days of hospital and ICU utilization were also similar between locations (μ 33 BPCH, 28 NUH and 12 BPCH, 13 NUH).
Conclusions: Despite variation in resource availability with significant differences in rapid transport time to higher level of care, monitoring capacity/utilization, and therapeutic approaches; there were no significant differences in terms of survival and overall functional outcomes between the two populations with homogenous demographics and injury severity.

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**Big Data Research in Neurosurgery: A Critical Look at this Popular New Study Design**

***Michael, Madison, MD***

**Object:**
The use of "big data" in neurosurgical research has become increasingly popular. However, using this type of data comes with limitations. This study aimed to shed light on this new approach to clinical research.

**Methods:**
We compiled a list of commonly used databases that were not specifically created to study neurosurgical procedures, conditions, or diseases. Three North American journals were manually searched for articles utilizing these and other non- neurosurgery-specific databases. Data regarding study topic, question, database used, sample size, journal, publication date, and others were then collected, tallied, and analyzed.

**Results:**
A total of 324 articles were identified since 2000 with an exponential increase since 2011 (257/324, 79%). The Journal of Neurosurgery Publishing Group published the greatest total number (n=200). The National Inpatient Sample (NIS) was the most commonly

used database (n=136). The average study size was 114,841 subjects (range, 30-4,146,777). The most prevalent topics were vascular (n=77) and neuro-oncology (n=66). When categorizing study objective (recognizing that many papers reported more than one type of study objective), "Outcomes" was the most common (n=154). The top 10 institutions by primary or senior author accounted for 45-50% of all publications. Harvard Medical School was the top institution, using this research technique with 59 representations (31 by primary author and 28 by senior).

**Conclusion:**
The increasing use of data from non-neurosurgery-specific databases presents a unique challenge to the interpretation and application of the study conclusions. The limitations of these studies must be more strongly considered in designing and interpreting these studies.

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**Dual anti-platelet therapy is associated with reduced risk of clinical vasospasm and delayed cerebral ischemia in aneurysmal SAH**

***Schulder, Michael, MD***

**Objective:**
To evaluate the efficacy of Gamma Knife radiosurgery (GKRS) as treatment in patients with 10 or more metastatic brain tumors.

**Methods:**
Between February 2014 and January 2016, 20 patients were treated with GKRS for 10 or more brain metastases. We retrospectively analyzed the data from these patients, with survival and tumor control as primary endpoints. Patient age, primary diagnosis, tumor location, radiation dose, KPS, and previous and subsequent treatments were examined for their relationship to outcome. Brain volumes treated with 8 Gy and 12 Gy were measured to explore volume of treated tissue as a contributing factor to tumor control. Pre-treatment and post-treatment magnetic resonance imaging (MRI) studies were reviewed at intervals of 3 months, as were patient records on site.

**Results:**
20 patients treated, with a median age of 61 years (range 19-76). They had a total of 357 tumors, with a median of 17 tumors per patient (10-34). The median survival for these patients was 12.5 months (1.3-16.9). Patient survival was censored at the time of data collection, and the true upper limit of survival is higher than recorded here. The mean percent of brain volume treated was 0.9, with a median of 0.41 (0.07 – 3.38). The mean percent of brain volume that received a dose of 12 Gy was 5.0 (0 – 21.0), and of 8 Gy was 9.0 (1.0 – 31.0). For each of the first three 3-month intervals, the median percent of tumor control was 97%, 96%, and 100%, respectively in the patients with available data.

**Conclusion:**
GKRS effectively treats and controls brain tumors, even in patients presenting with 10 or more tumors simultaneously. The number of tumors initially present was not found to have a significant correlation with tumor control.

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**Current Oncolytic Viral trials in Glioma**

***Markert, James, MD***

The development of the field of oncolytic viruses (OV) has made remarkable strides over the past quarter of a century, from the first construction of a genetically-engineered oncolytic virus and demonstration of its efficacy in preclinical models to the approval by the FDA of T-VEC for the treatment of metastic melanoma. We have concentrated on the development of OV for the treatment of malignant brain tumors and will report on our progress with clinical testing of three such viruses. The first virus, G207, is an oncoytic herpes simplex virust type-1 (oHSV) and was engineered to contain two distinct mutations to limit its ability to replicate in normal tissues. This virus has been extensively examined in three different Phase I trials in adult patients with recurrent malignant glioma and has been found to be safe, alone and when used in combination with radiation therapy. Inoculation into brain harboring invasive tumor also appeared to be safe. Currently, we have designed and are accruing patients to a new Phase I trial utilizing G207 to treat pediatric patients with recurrent malignant brain tumors of varying histologies. Initial patients were treated with 1 x 107 plaque forming units and no dose limiting toxicities have been observed, with some indications of response to the therapy. A second Phase I trial, utilizing the M032 virus, is also underway at UAB in adult patients with recurrent malignant glioma. M032 is also an oHSV but it differs from G207 in two important ways: first, it only contains a single mutation to eliminate neurovirulence, increasing its ability to replicate within tumor without producing additional neurotoxcity; and second, it expresses the human form of IL-12 expressed by a constitutive promoter. IL-12 is a cytokine that produces an antitumor immune response as well as having an antiangiogenic effect. An initial cohort of patients has been treated with M032 without adverse effects. Finally, C134 is a chimeric

oHSV that contains a single mutation similar to the M032 virus but instead of expressing IL-12, expresses a gene from the human cytomegalovirus that further increases the replication ability of the virus while producing an antitumor immune response of its own. C134 has recently received an IND from the FDA and is preparing to enter human trials as well. We will discuss the status of these trials and summarize our findings to date from these efforts.

**Profiling circadian rhythm and energy metabolism genes in response to traumatic brain injury**

***Ecklund, James, MD***
Robert Lipsky, PhD, and Mingkuan Lin, PhD

A number of core regulatory genes have been identified in mammals that regulate the approximate 24 hour cycle of biological timekeeping responsible for maintaining physiological and behavioral circadian rhythm. These genes encode protein transcription factors that act on one another in a series of interlocking biochemical feedback loops. One persistent complaint among individuals subjected to mild traumatic brain injury (TBI) is sleep disruption (Bramoweth and Germain, 2013) which is associated with a shift in the approximate 24 hour cycle for maintaining circadian rhythm and in dysfunction in energy metabolism (Sikuglu et al 2015). We tested the hypothesis that circadian rhythm genes are chronically dysregulated when rats are exposed to moderate blast and that human subjects with a history of TBI would have altered DNA signatures of energy metabolism genes.

To determine if changes in circadian rhythm genes occurred after mild TBI, total RNA from right hemisphere samples were prepared from two groups of rats, blast exposed and normal controls. The conditions for blast were 15 psi with a survival time of six weeks. Animals from blast only and control conditions were sacrificed with a mean difference of approximately two hours between the two groups (time at sacrifice equal to zeitgeber times [ZT] ZT16-ZT18, equal to 22-24 hr, night). Whole genome RNA sequencing (RNA-Seq) was performed using an Illumina HiSeq2000 platform. From a total of 271 genes showing at least a two-fold change in expression in blast compared to control, analysis based on Kyoto Encyclopedia of Genes and Genomes (KEGG) pathways showed that a number of gene sets were involved in different biochemical pathways that were affected by blast conditions. In particular, the levels of two core clock gene mRNAs were increased after blast, Per1 (Period homolog 1) and Rev-erba (Rev-erbα, Nuclear receptor subfamily 1, group D, member 1). The increased mRNAs in blast exposed animals occurred during ZT conditions where the Per1 and Rev-erba are expected to increase, such that blast appears to potentiate the increase in these two transcription factors. Per1 and Rev-erba are known to serve as transcriptional repressors of Clock and Bmal1, which are positive regulators of clock output genes in brain and in regulating circadian cycles in metabolism in other tissues. Increasing levels of these transcription factors is predicted to cause a phase delay in the circadian cycle.

In human studies, we examined DNA methylation profiles, a stable mark for changes in gene expression, to determine if a history of TBI was associated with longer term changes in DNA methylation of energy metabolism genes. In the human studies, DNA was isolated from peripheral blood mononuclear cells from active duty US Coast Guard personnel from the same location matched by age, race, and sex (4 life time TBI and 4 no injury controls). Whole genome DNA methylation profiles were captured using an Illumina Human Methylation 450K BeadChip, which examines control regions of genes for quantitative differences in DNA methylation between the two groups of individuals. Two genes involved in energy expenditure/metabolism that are also expressed in brain passed a false discovery rate test: MFSD2A and ATP5G1. MFSD2A showed a 35% decrease in DNA methylation while and ATP5G1 showed a 32% increase in DNA methylation between individuals with a history of TBI compared to controls.

If these findings are replicated and validated using qRT-PCR and protein blots, behavioral experiments could then be performed to determine the effect of blast on locomotor activity during a period where the rats would be maintained in constant darkness in order to reveal potential shifts in their activity when the circadian clock is allowed to operate free of light-induced entraining (resetting of the circadian clock). In addition, long term changes in metabolism predicted by deranged circadian regulation can be evaluated following recovery from blast injury in pre-clinical animal models and in TBI patients.

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**Blood based test for Brain Tumors**

*Nahed, Brian, MD*

Despite advances in surgery, chemotherapy, and radiation therapy, patients with malignant brain tumors have inevitable recurrence. Traditionally, brain tumor cells were thought to remain intracranially, however, our laboratory has identified glioblastoma cells and exosomes in the peripheral blood of patients with glioblastoma. Currently, the diagnosis of brain tumors requires surgery both at initial presentation and at recurrence. Methods to differentiate tumor recurrence from post-chemoradiation (pseudoprogression) therapy using magnetic resonance imaging have failed, and ultimately patients require surgery which provides information at one time point. Clinically, there is a dire need to diagnose and monitor brain tumor recurrence and to detect mutations in real time to guide patient treatment. A blood-based 'liquid biopsy' that captures and analyzes exosomes and circulating tumor cells (CTCs) would be the ideal approach to diagnose and distinguish tumor recurrence from pseudoprogression in glioblastoma. We propose the first technology to simultaneous analyze CTCs and exosomes.

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**Correlates of facial nerve outcomes after acoustic neuroma surgery: Results of a consecutive series at a tertiary care center.**

*Morcos, Jacques, MD*

**Introduction:**
Preservation of facial nerve function is an important goal after acoustic neuroma resection. Multiple variables have been studied for their association with satisfactory facial nerve function following the three classic surgical approaches to this tumor. Tumor size, preoperative radiation, experience of the surgical team, intraoperative nerve continuity, and evoked responses have consistently been associated with postoperative facial nerve outcomes. Our goals, in this first phase study, are to substantiate facial nerve outcomes and their correlates after acoustic neuroma surgery.

**Methods:**
This is a retrospective consecutive chart review study, over a seven-year period at a single tertiary care center. A substantial number of patients did not have complete information and were excluded. The study consists of the remaining 192 eligible patients.
Results: All patients were operated on by the same neurosurgeon (JJM), in association with one of 3 neurootologists. Our population was largely Caucasian (92%), and the majority were female (56%). Mean follow-up was 34 months. Mortality was 0%. More tumors (60%) were resected from the right side. Patients underwent a retrosigmoid (63.5%), translabyrinthine (32.3%) or middle fossa approach (3.7%). One-quarter of the surgeries were performed on tumors proven to have enlarged. Prior treatment was assessed: 10% had prior radiation and 3% prior resection. Gross total (100% volumetric resection) or Near-Total resection (95-99% volumetric resection) was achieved in most (88%) cases. Tumor size was inversely correlated with extent of resection ($p<0.001$). Facial nerve function was assessed using the House-Brackmann (HB) scale immediately post-operatively and then at final follow-up. Facial nerve outcomes were stratified as good (HB I-II) or poor (HB III-VI). 39% of patients had some facial weakness immediately postop, yet 49% of them improved to HB I at final follow-up and 70% to HBI-II, resulting in a total of 88% of patients having good facial nerve function at last follow-up. The surgical approach was not significantly associated with facial nerve function. A significant correlation was found between the amplitude required to stimulate the facial nerve proximally at end of resection and the final HB grade ($p<0.0001$). Interestingly, surgeon's impression of an abnormal appearing facial nerve intra-operatively was associated with HB score immediately following surgery ($p = 0.0006$). Recurrence or progression requiring additional treatment was seen in 7% of patients for whom at least 2 years of follow-up data was available. These recurrences occurred in patients with an initial mean volumetric tumor resection of 93%.

**Conclusion:**
Immediate facial nerve weakness after aggressive surgical resection of acoustic neuromas is common, yet the majority of patients will improve, leading to a close to 90% HB I-II at final outcome. Facial nerve outcomes correlate with tumor size, surgical appearance of facial nerve, extent of resection, and intraoperative brainstem exit zone stimulation. These results justify the continued policy of intention for gross total resection, modified by intraoperative judgment based on monitoring and facial nerve appearance.

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## Relief of intractable nausea after resection of hemangioblastoma of the distal medulla in patients with von Hippel-Lindau disease: a clinical series.

*McCutcheon, Ian, MD*

**Introduction:**
Symptoms of hemangioblastomas in von Hippel-Lindau disease (VHL) depend on tumor location, and the common predilection for cerebellum and brainstem leads to issues with balance, strength, coordination, cranial nerve palsies, and nausea. In the absence of increased intracranial pressure, the physiological basis of the nausea is hypothesized to be disruption of function of the area postrema (AP), which sits just cranial to the obex in the floor of the distal fourth ventricle, and induces nausea when visceral afferents or afferents from extramedullary brain centers are stimulated, or when chemical changes in blood activate its chemoreceptors.

**Methods:**
Patients (n=145) treated for VHL at the M D Anderson Cancer Center from 2000-2015 included those with hemangioblastoma of the neuraxis (n=123), of whom a small subset suffered intractable nausea (n =5) with hemangioblastoma located in or near the distal medulla. 4/5 had a family history of VHL. Age ranged from 19 to 48 years at time of surgery, 4/5 patients were female, and 2/5 had an associated cyst. Patients had one (n=3), two (n=1), or four (n=10) tumors on or near the AP. None had hydrocephalus. No patient without tumor near the AP had intractable nausea; all but two with tumor near the AP had this complaint.

**Results:**
Complete relief occurred in 4/5 cases within 10 days of tumor removal. In the fifth case, postoperative CSF leak delayed resolution to one month. In all patients here reported, tumor either sat immediately adjacent to or within the AP, or a tumor-associated cyst compressed it.

**Conclusion:**
Etiologies of the nausea include direct disruption or compression of the AP, or shifts in perfusion of this region caused by tumor hypervascularity and AV shunting. Nausea in patients with VHL can be caused by other conditions associated with the disease (e.g., pancreatic cysts or tumors), or by hydrocephalus, but this symptom should trigger a search for hemangioblastoma of the distal medulla. As such patients are resistant to anti-emetic medications, surgery can offer prompt and prolonged benefit.

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## Limbic System Surgery for Psychiatric Disorders: A "Precision Medicine" Approach

*Sheth, Sameer, MD*

**Introduction:**
Mental health disorders affect millions of people worldwide and represent a substantial economic and social burden. Considering depression and obsessive-compulsive disorder (OCD), for example, approximately 20-30% of these patients remain refractory to pharmacological and behavioral treatment. Neurosurgical management of these severe, refractory patients with stereotactic lesions (e.g. capsulotomy, cingulotomy) or deep brain stimulation (DBS) has been available for decades, but utilization remains limited to a few specialized centers. Although outcomes continue to improve, there is still significant response heterogeneity. We suggest that a significant barrier to further improvements in outcome is our as yet rudimentary understanding of the involved circuits. Improved appreciation of fronto-limbic circuits, their connectivity, and the effects of modulating them will inform surgical targeting strategies. We have taken a two-pronged approach to address this unmet need. First, we statistically analyze a large cohort of previously treated patients to develop a model of the relationship between target and outcome. Second, we study structural connectivity profiles in a large national neuroimaging dataset (Human Connectome Project, HCP) to identify the brain network modulated by these procedures.

**Methods:**
First, we identified 30 patients with severe, refractory OCD who had previously been treated with capsulotomy (lesion in the anterior limb of the internal capsule, ALIC) using stereotactic radiosurgery (SRS) at Brown University, University of Sao Paulo, Brazil, and Columbia University. Lesions were traced on postop T1 volumetric images, and lesion masks were transformed to standard MNI space. We used a general linear model to test for the voxel-wise relationship between lesion location and outcome (as measured by the standard OCD symptom scale, YBOCS), using standard cluster-enhanced family-wise error correction to account for multiple comparisons. Second, we obtained diffusion tensor imaging (DTI) data from 842 healthy control subjects in the national HCP database. We used these data to segment the ALIC based on the cortical origin of the fibers contained within it. To do so, we performed connectivity-based seed classification using voxels within the ALIC as seed regions and frontal Brodmann areas (BAs) as independent targets. We

combined these segmentations for group analysis by assigning each ALIC voxel to the most frequently associated frontal BA in the individual segmentations. This analysis was performed across the group of 842 individuals using deterministic tractography, and for a subset of 40 individuals using probabilistic tractography for further validation. We calculated the Sorensen-Dice index to compare the spatial similarity of each segmentation across individuals. Finally, we combined the information from these two analyses to identify cortical regions mostly commonly affected by these capsulotomy procedures.

**Results:**
Twenty-four of the 30 patients (80%) were full responders to the intervention. A region of voxels located in the anteromedial aspect of the right ALIC demonstrated a significant relationship to YBOCS reduction, suggesting that inclusion of this region within the stereotactic target was statistically associated with improved outcome. The ALIC segmentation demonstrated a posterior-superior to anterior-inferior axis of organization within the ALIC. On average, the frontal BA assignments of voxels in the group analysis were consistent with only 66.2% of individuals' segmentations, suggesting a significant degree of inter-individual anatomical variability within the ALIC. The most common cortical region affected by the lesions was BA11 (orbitofrontal cortex, OFC), accounting for 63.9% of the volume of modeled lesions. BA11 only accounted for 12.1% of all ALIC fibers by volume, however. The Sorensen-Dice index of similarity for BA11, which was the highest among all BAs, ranged between 33.5 and 71.4%.

**Conclusions:**
This cohort represents the largest collection of patients treated with SRS for OCD assembled to date. Given the sample size, we were able to statistically identify regions associated with greater likelihood of symptomatic improvement. The tractography analyses complemented the clinical data with information regarding the cortical regions affected by lesions within the ALIC. The combined dataset provides important new insights into fronto-limbic circuitry and its targeting for psychiatric neurosurgical procedures: 1) capsulotomy primarily affects fibers coursing between OFC and thalamus; 2) inclusion of a region within the anteromedial ALIC (possibly favoring the right side) is statistically associated with improved outcome; 3) there is significant inter-individual variability in the location of OFC fibers within the ALIC. These results suggest that further optimization of neuromodulatory procedures targeting fronto-limbic circuitry within the ALIC will need to account for its anatomical variability. Future studies should incorporate information provided here with individualized connectivity analyses for each patient. We propose that this "precision medicine" approach to psychiatric neurosurgery will lead to better understanding of the involved circuitry, improved outcomes, and thereby hopefully to increased acceptance of these procedures for the tremendous number of severely affected patients who could benefit from them.

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**The Changing Face of Epilepsy Surgery: New Approaches to Old Problems**

***Mckhann, Guy, MD***

Epilepsy surgery has changed little in the past several decades. However, the recent development of new technologies and approaches has radically changed the surgical candidacy, perioperative risk, and efficacy of epilepsy surgery for both mesial temporal and extratemporal lobe epilepsy. For mesial temporal lobe epilepsy (MTLE), stereotactic laser ablation (SLA) of the hippocampus and amygdala is an excellent first choice surgical option in cases of mesial temporal sclerosis and well localized cases of nonsclerotic ("MRI normal") MTLE. SLA has minimal morbidity and a 1-year seizure freedom of 50-60%. For extratemporal epilepsy, the majority of cases are MRI normal and more difficult to localize. The adoption of stereoEEG (SEEG) robotic technology provides a safer and less invasive option for surgical lateralization and localization of the seizure onset zone(s). In select cases, the combination of SEEG and SLA can achieve dramatic seizure improvement while avoiding open surgical procedures for either localization or resection. Representative cases will be presented to illustrate these concepts.

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**Tales from the Veld: Churchill, Gandhi, and Smuts.**

***Nanda, Anil, MD***

South Africa, during the Boer War, was a place that the titans of the twentieth century interacted by serendipity. General Smuts, who became one of the great leaders for South Africa, was on the opposing side of the Boer War, while Churchill was a young Lieutenant who was captured and escaped in dramatic fashion. His dispatches created a sensation in England and established him as a leader. His supreme self-confidence was evident in a letter to his mother at the age of 23 in which he wrote, "I do not believe the Gods would create so potent a being as myself for so prosaic an ending." Gandhi volunteered to be a

health worker and they may have interacted during the Boer War. Gandhi spent twenty years in South Africa and his political consciousness evolved into the nonviolent movement. When Gandhi left South Africa Smuts would say, "The saint has left our shores, hopefully never to return." Smuts went on to be part of the War Cabinet, both for World War I and World War II. Churchill and he became close friends. They both lost the elections after World War II, while Gandhi was instrumental in the independence of India. This was a time in history that had ramifications for the continents of Asia, Africa, and Europe. Their interaction in the Boer War was a transformative experience.

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**The impact of surgery on survival after progression of glioblastoma: a contemporary analysis**

***Curry, William, MD***

**Background:**
Despite updated management of glioblastoma (GB), progression is inevitable. Previous data suggest survival benefit from resection at progression; however, relatively few studies have evaluated the role of surgery in the context of contemporary treatment and, in particular, widespread bevacizumab use. Therefore, the purpose of this study is to evaluate outcomes following surgical resection in patients with recurrent GB since 2008.

**Methods:**
The records of 563 patients who underwent biopsy or resection of GB between January 1, 2008, and December 31, 2015, were retrospectively identified and reviewed. Median survival and 95% confidence intervals were generated with the Kaplan-Meier method. Multivariate analysis, which controlled for age, Karnofsky Performance Status (KPS), extent of resection, adjuvant chemotherapy and radiation, clinical trial enrollment, tumor location, and tumor multifocality, was carried out using a Cox proportional hazards model for post-progression survival.

**Results:**
Of 368 patients with progressive disease, 88 (23.9%) underwent craniotomy for resection at first progression. The median post-progression survivals for patients who did and did not undergo resection at this time were 12.8 and 6.9 months, respectively. In multivariate analysis, KPS ≥ 70 at progression (HR 0.428), gross total resection (GTR) after progression (HR 0.553), and receipt of bevacizumab postprogression (HR 0.455) were associated with increased post-progression survival.

**Conclusions:**
The results of this study demonstrate that surgery for progressive GB may only improve post-progression survival if GTR is achieved. For patients in whom GTR is not feasible or likely, bevacizumab may be a surgery-sparing treatment for disease progression.

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**Model of Cerebral Ischemia and Potential treatments**

***Rosen, Charles, MD***

**Background and Purpose:**
Blood-brain barrier (BBB) disruption and hemorrhagic transformation (HT) following ischemic/reperfusion injury contributes to post-stroke morbidity and mortality. Bryostatin, a potent protein kinase C (PKC) modulator, has shown promise in treating Alzheimer disease, global ischemia, focal ischemia and traumatic brain injury, but the underlying mechanism of bryostatin requires further investigation. In the present study, we tested the hypothesis that administration of bryostatin can limit BBB disruption, brain swelling, mortality and HT following ischemic stroke, prolonging the time window for administering recombinant tissue plasminogen activator (r-tPA) in an aged female rat model. The suggested mechanism is down-regulation of matrix metalloproteinase-9 (MMP-9) activation and regulation of PKCε activation.

**Methods:**
Cerebral vascular ischemia was produced by reversible occlusion of the right middle cerebral artery (MCAO) in 18-20-month-old female rats using an autologous blood clot with delayed r-tPA mediated reperfusion. Bryostatin (or vehicle) was administered at 2 h post-MCAO and r-tPA was administered at 6 h post-MCAO. Functional assessment, lesion volume, and hemispheric swelling measurements were performed at 24 h post-MCAO. Assessment of blood brain barrier permeability, measurement of hemoglobin, assessment of MMP levels by gel zymography, and measurement of PKCε, PKCα, PKCδ by Western Blot were conducted at 24 h post-MCAO. Brain swelling and mortality were also assayed.

**Result:**
Rats treated with bryostatin prior to r-tPA administration had decreased mortality and edema formation compared with rats treated with r-tPA alone. Administration of bryostatin also limited BBB disruption and HT at 24 h post-MCAO. We report down-regulation of MMP-9 and up-regulation of PKCε in bryostatin-treated rats.

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**Conclusions:**
Bryostatin can ameliorate the extent of BBB disruption and reduce the risk of HT in animals treated with TPA at 6 hours after induction of ischemia in comparison to control animals. This is thought to be occurring as a consequence of down-regulating MMP-9 activation and up-regulating PKCε at 24 h post-MCAO. Bryostatin treatment lengthened the time-to-treatment window and enhanced the efficacy and safety of thrombolytic therapy at delayed timepoints of r-tPA administration.

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**Instrumenting long and fusing short in young children undergoing occipital-cervical-thoracic stabilization: Technical note and case series**

***Anderson, Richard, MD***

**Introduction:**
The long-term effects of instrumentation and fusion of the occipito-cervico-thoracic spine on spinal growth in young children are poorly understood. In order to minimize the effects of this surgery on the growing pediatric spine, we report a novel technique in four children with cervico-thoracic instability who underwent instrumentation from the occiput to the upper thoracic region for stabilization but without bone graft at the craniovertebral junction (CVJ). Subsequent surgery was then performed to remove the occipital instrumentation, thereby allowing further growth and increased motion across the CVJ.

**Methods/Results:**
Three very young children (15, 30, and 30 months old) underwent occipital to thoracic posterior segmental instrumentation due to cervical or upper thoracic dislocation, progressive kyphosis, and myelopathy. One child (10 years) underwent similar instrumentation for progressive cervico-thoracic scoliosis. Bone graft was placed at and below C2 only. After follow-up CT scan demonstrated posterior arthrodesis without unintended fusion from O-C2, three patients underwent removal of the occipital instrumentation. Follow-up cervical spine flexion/extension radiographs demonstrated partial restoration of motion at the CVJ. One patient has not had removal of the occipital instrumentation yet because she is only four months postoperative.

**Conclusion:**
Instrumenting long while fusing short provides an opportunity for spinal stabilization in young children while reducing the effects on spinal growth and motion. This technique can be considered in children who require longer instrumentation constructs for temporary stabilization but only need fusion in more limited areas where spinal instability exists.

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**MSC-derived Exosomes Carrying microRNAs in the Treatment of Human Gliomas**

***Lang, Fredrick, MD***

A promising new paradigm in GBM therapy is treatment with microRNAs (miRs), which are small, noncoding RNAs that are powerful regulators of gene expression. We and others have shown that certain miRs (e.g., miR-124 and miR-128) are capable of inhibiting the growth of gliomas in vitro. However, because miRs are unstable in blood, it is currently unknown how these miRs will be delivered to patients. To address this problem, we exploited the observation that bone marrow mesenchymal stem cells (MSCs) secrete exosomes, which are nanoscale (50-100nM) vesicles that function as intercellular transport vehicles. We hypothesize that exosomes from cultured MSCs (called Exos) can be used to systemically deliver anti-glioma miRs to GBMs. To test this hypothesis, we first showed that MSCs could package miRs-of choice into exosomes. Specifically, MSCs were transduced with lentiviruses containing miR-124 or miR-128, and after 48hrs exosomes (Exos-miR-124 or Exos-miR-128) were isolated from the supernatant, lysed, and RNA was analyzed by qRT-PCR using primers for miR-124 and miR128. The level of miR-124 or miR-128 in the collected exosomes was significantly greater than controls ($P<0.0001$). To show that the isolated Exos are capable of homing to human gliomas in vivo, we labeled Exos with an infrared dye (DiR-Exos) and injected them intraperitoneally (IP), intravenously (IV), or intra-arterially (IA) into mice harboring intracranial gliomas (U87, GSC267 or GSC17). Bioluminescence imaging identified DiR-Exos exclusively within the tumors, with IA resulting in the highest signal, but IP and IV also being effective. To demonstrate that Exo-miRs are able to inhibit the growth of GSCs and down regulate target genes, we treated a panel of 5 GSCs with Exo-miR-124 and showed a significant reduction in viability of all GSCs compared with controls. Analyses of post-treatment protein lysates by immunoblot using an antibody to the known miR-124 target gene, FoxA2, showed treatment with Exo-miR-124 was capable of down regulating FoxA2. In similarly designed experiments, treatment of GSC17 or U87 with Exo-miR-128 also resulted in significant reduction in cell viability, and inhibition of miR-128 target genes, BMI-1 and SUZ. In order to assess efficacy of Exos in in vivo, GSC267 was implanted into the frontal lobe of nude mice (N=8/group) and after 7 days animals were treated with Exo-miR-124, Exo-miR-Ctrl, or PBS by IP injection (1010 Exos/100 l) every other day until the animals became moribund.

Whereas all controls were dead by 60 days after tumor implantation (median survival Exos miR-Ctrl = 54 days; PBS = 55 days), 50% of the animals treated with Exos-miR-124 were alive at 90 days (median survival: 79 days, P<0.0001). Taken together, these data support the concept that systemically delivered exosomes carrying an antiglioma miR can home to brain tumors, inhibit target genes and kill GSCs in vivo. These data provide the first proof that Exos can be used as vehicles for intravascular delivery of anti-glioma miRs.

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**Critical evalutation of Stroke Alert protocol: Time for change**

***Liebman, Ken, MD***

Stroke, a Neurosurgical Disease

Traditionally patients presenting to the hospital with the diagnosis of acute ischemic stroke are usually evaluated by the ER physician, then a neurology attending, resident or teleneurology. Although this may be the only option in some facilities, a "better" approach if applicable, maybe to immediately inform the cerebrovascular neurosurgeon of the presence of the patient. It is a more efficient, more effective approach toward patients who develop an acute stroke and will likely result in an increased number of those patients receiving IVtPA, those appropriately being treated with endovascular intervention and possibly result in improved outcomes.

**Methods:**
A retrospective review of patients presenting to the ER with a diagnosis of ischemic stroke. We reviewed those patients who presented before and after the policy of immediately calling the cerebrovascular neurosurgical attending regarding an ischemic stroke. The variables measured included, number of patients who: received the correct vascular workup, received IVtPA, were correctly dx with a large vessel occlusion, correctly identified with a treatable penumbra, and those who underwent endovascular intervention.

**Result:**
From 2014 to 2016, patients who presented to Hahnemann University Medical Center with a dx. of ischemic stroke were analyzed. Patients who presented before and after the policy was implemented were compared. We specifically assessed the variables described above and compared the results.

**Conclusion:**
Our new policy resulted in a much more efficient, complete and accurate evaluation of those patients diagnosed with an acute ischemic stroke. Immediately informing the cerebrovascular neurosurgical attending about the presence of such a patient resulted in a greater number of these people receiving the appropriate IV, and or endovascular treatment. This will very likely result in improved functional outcome.

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**Proof of Concept: Robotic Sympathectomy**

***Erkman, Cherie, MD***

**Background:**
Sympathectomy is a procedure shared by neurosurgeons and thoracic surgeons to treat hyperhidrosis, Raynaud's disease and reflex sympathetic dystrophy. Traditional approaches to sympathectomy include thoracotomy and endoscopic/video assisted thoracoscopic surgery (VATS). We sought to provide proof of concept for robotic sympathetic denervation, a technique not yet described.

**Methods:**
Two patients underwent sequential left then right placement of three 8 mm robotic ports and hemithorax insufflation with carbon dioxide. The robot was positioned to visualize, dissect and ablate or clip the sympathetic chain. Negative pleural space pressure was reconstituted with routine maneuvers of valsalva and removal of a chest tube attached to suction.

**Results:**
Use of the robot allowed for a single supine positioning and three 8 mm incisions on each side. The magnified, three-dimensional optics provided excellent visualization of the sympathetic chain. Robotic instrumentation with wrist-action facilitated dissection of the sympathetic chain without levering pressure on the ribs and intercostal nerves.

**Conclusion:**
Robot assisted sympathectomy is not only feasible, but superior in visualization and precision of dissection to traditional techniques.

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**Analysis of 3,298 Consecutive Neurosurgical Cases Demonstrates that Overlapping Surgery Has No Adverse Effect on Patient Outcome**

***Barrow, Dan, MD***

**Importance:**
Overlapping surgery is commonly practiced. However, a dearth of evidence exists to support or refute the safety of overlapping surgery.
**Objective:**
To determine whether overlapping surgery is associated with worsened morbidity and mortality in a large series of complex, neurosurgical cases.

**Design:**
A retrospective cohort study was completed for all patients who underwent neurosurgical procedures at Emory University Hospital between January 1, 2014 and December 31, 2015. Logistic regression models were executed to compare outcomes for overlapping and nonoverlapping surgery. Investigators were blinded to study cohorts during data collection and analysis.

**Main Outcome(s) and Measure(s):**
The primary outcome measures were 90-day postoperative mortality and morbidity.

**Results:**
Of 3298 operations, 1518 (46%) were nonoverlapping while 1780 (54%) were overlapping. The mean age was similar across study groups. The majority of the cohort was female (54% vs. 46%). Patients who underwent overlapping surgery were more likely to be female (56% vs 44%, p=0.002). The distribution of American Association of Anesthesiologists Score was similar between overlapping and nonoverlapping surgery cohorts. Median (IQR) surgical times, in-room and skin-to-skin, were significantly longer for overlapping surgery (203[153.8] vs 173[148.3]; p<0.001 and 125[130] vs 98[120]; p=0.002) than nonoverlapping surgery. Overlapping surgery was more frequently elective (91.3% vs 84.3%; p<0.001). Regression analysis failed to demonstrate a correlation between overlapping surgery and complications such as mortality, any or severe morbidity or unplanned readmission. Measures of baseline severity of illness, such as ASA > 3 and emergent surgery, or complexity of surgery, such as the presence of a co-surgeon associated with mortality, overall and severe morbidity, unfavorable discharge location and functional status, both at discharge and follow-up (OdR > 1, CI > 1 for all).

**Conclusions and Relevance:**
These data indicated that overlapping surgery can be safely performed if appropriate safety precautions and patient selection are followed. Data such as these will help determine healthcare policy to maximize patient safety, but also make highly specialized surgical care available to as many patients as possible.

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**A 2-year old with a self-inflicted gunshot wound to the head: Patterns in pediatric cranial ballistic injuries Ruth Bristol**

***Bristol, Ruth, MD***
Ruth Bristol, Allyson Alexander, John Sheehy, Shelley Flecky, David Notrica,

Each year, thousands of children suffer from gunshot wounds. It is the second most common cause of trauma deaths in American children. In contrast to adults, the vast majority of pediatric injuries are accidental. There is little hard data on the true incidence of pediatric cranial gunshot wounds. Research has been difficult to fund for political and economic reasons.

**Methods:**
An IRB-approved review of the trauma database for Phoenix Children's Hospital from 2008 to 2015 was performed. Children aged 0-18 years were included. The electronic records for all patients suffering gunshot wounds to the head and neck were reviewed.

**Results:**
37 patients suffered injuries to the head and neck. The most common age of injury was 14, with a range of 2-17 years. 7/37 patients were female. The involved weapon was a street or hunting firearm in 60%. Seven patients died, who all had a presenting GCS of 3 with injuries caused by handguns or rifles. Of those who survived, 26 had a Glasgow Outcome Score (GOS of 5), 2 had a GOS of 4, and 2 had a GOS of 2. The majority of the injuries occurred at a residence with a gun owned by a family member. Suicide attempts accounted for 6/37 (16%) of injuries. Children injured by BB or air pellet guns were significantly younger than those injured by standard firearms (9 vs 12; P=0.009). The median income of these children's home zip codes are, on average, $10,000 below the state median. The average hospital charges for the initial admission were $151,636. Other reported variables include treatment course, surgical intervention, and socioeconomic and demographic information.

**Conclusion:**
The use of hand guns by and around children is concerning and requires further investigation. Better gun safety education is clearly needed for this public health issue.

## Functional Outcome in Patients with Aneurysmal Subarachnoid Hemorrhage

***Brown, Ben, MD***

To date, the use of the flow diverting Pipeline

**Introduction:**

Patients with subarachnoid hemorrhage (SAH) can suffer from cognitive changes with considerable impact on functional outcomes. Traditional outcome measures include radiological and clinical results with less attention paid to functional and neuropsychological effects. This is a pilot study to collect prospective data on functional outcome in patients with SAH in the form of cognitive and neuropsychology evaluation. The goal is to better understand how specific treatment subtypes ultimately affect the outcome and prognosis.

**Methods:**

Thirty patients with SAH Hunt Hess Score (HH) <3, age range 18-80 years, and with the ability and willingness to return for follow up visits were identified. Identified patients were evaluated after admission for a baseline measurement and prospectively after treatment at 1, 3, 6, and 12-months. Functional measures included the Montreal Cognitive Assessment (MOCA), Symbol Digit Modalities Test (SDMT; oral version), the Trail Making Test Parts A and B (TMT A/B), the Mayo Portland Participation Index (M2PI), and the Neuropsychiatric Inventory—Questionnaire (NPI-Q).

**Results:**

Nineteen patients were available for follow up at 12 months, 21 at 6 months, and 23 at 3 months. The median age was 52.7 years with 21 women and 9 men. General cognitive function as measured by total MOCA score showed improvement from baseline (Mean= 23.7, SD: 3.90) to follow up at 12 months (Mean = 25.6, SD: 3.84). Memory as measured by MOCA score showed a general trend towards improvement from baseline (Mean= 2.6, SD: 1.83) to follow up at 1 year (Mean: 3.6, SD: 1.50). All other functional measures showed a plateau in improvement by month 6. Behavior and daily function measured by the NPI-Q showed improvement from baseline through follow up at 1 year.

**Conclusions:**

Our findings suggest that memory and cognitive function improve over time and patients with SAH regain cognitive functions at a different pace. Further studies are needed to explore the relation between different treatment modalities and the pace of functional recovery and the effect on prognosis.

## Relationship between aneurysm size and distal cerebral hemodynamics

***Charbel, Fady, MD***

**Introduction:**

The impact of aneurysms on distal cerebral hemodynamics is unknown. Here we examine the relationship between aneurysm size and distal hemodynamics prior to treatment.

**Methods:**

Patients seen at our institution between 2006-2015 with aneurysms within the cavernous or supraclinoid ICA segment(proximal to ICA terminus) were retrospectively reviewed. Only un-ruptured proximal anterior circulation aneurysms were included, patients with contralateral aneurysms were excluded. Patients were included if they had flow volume rate and flow velocities measured prior to any treatment using Quantitative MRA. Pulsatility index (PI) = [(systolic - diastolic flowvelocity)/mean flow velocity] was calculated for ipsilateral and contralateral MCA and ICA. Hemodynamic parameters were analyzed with respect to aneurysm size.

**Results:**

42 patients were included. Mean aneurysm size was 13.5 mm (range 2-40mm). There was significant correlation (Pearson's) between aneurysm size and ipsilateral MCA PI (P=0.006;r=0.441), MCAipsilateral/ICAipsilateral PI ratio (P=0.003; r=0.57), and MCAipsilateral/ MCAcontralateral PI ratio (P=0.008; r=0.43).

**Conclusions:**

Larger aneurysm size is significantly associated with higher ipsilateral MCA PI, demonstrating that aneurysms change distal cerebral hemodynamics. Aneurysm treatment may thus acutely change those altered hemodynamics. Furthermore, these findings help illuminate the revascularization requirements for large aneurysms.

**Efficacy and outcomes of facial nerve–sparing treatment approach to cerebellopontine angle meningiomas**

***Sisti, Michael, MD***

Advanced microsurgical techniques contribute to reduced morbidity and improved surgical management of meningiomas arising within the cerebellopontine angle (CPA). However, the goal of surgery has evolved to preserve the quality of the patient's life, even if it means leaving residual tumor. Concurrently, Gamma Knife radiosurgery (GKRS) has become an acceptable and effective treatment modality for newly diagnosed, recurrent, or progressive meningiomas of the CPA. The authors review their institutional experience with CPA meningiomas treated with GKRS, surgery, or a combination of surgery and GKRS. They specifically focus on rates of facial nerve preservation and characterize specific anatomical features of tumor location with respect to the internal auditory canal (IAC).

**Methods:**
Medical records of 76 patients with radiographic evidence or a postoperative diagnosis of CPA meningioma, treated by a single surgeon between 1992 and 2016, were retrospectively reviewed. Patients with CPA meningiomas smaller than 2.5 cm in greatest dimension were treated with GKRS, while patients with tumors 2.5 cm or larger underwent facial nerve–sparing microsurgical resection where appropriate. Various patient, clinical, and tumor data were gathered. Anatomical features of the tumor origin as seen on preoperative imaging confirmed by intraoperative investigation were evaluated for prognostic significance. Facial nerve preservation rates were evaluated.

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**Single-institution's experience using the extended middle fossa rhomboid approach for the safe resection of hemorrhagic cavernomas involving the lateral pons**

***Levy, Mike, MD***

**Object:**
Treatment of hemorrhagic cavernous malformations within the lateral pontine region demands meticulous surgical planning and execution to maximize resection while minimizing morbidity. We report a single-institution's experience using the extended middle fossa rhomboid approach for the safe resection of hemorrhagic cavernomas involving the lateral pons.

**Methods:**
A retrospective chart review was used to identify and review the surgical outcomes of patients who underwent an extended middle fossa rhomboid approach for the resection of hemorrhagic cavernomas involving the lateral pons during a 10-year period at Rady Children's Hospital of San Diego. Surgical landmarks for this extradural approach were based on the Fukushima dual-fan model, which defines the rhomboid based on the following anatomic structures (1) the junction of the greater superficial petrosal nerve (GSPN) and mandibular branch of the trigeminal nerve (V3); (2) the lateral edge of the porous trigeminus; (3) the intersection of the petrous ridge and arcuate eminence (AE), and (4) the intersection of the GSPN, geniculate ganglion, and AE. The boundaries of maximal bony removal for this approach are the clivus inferiorly below the inferior petrosal sinus; unroofing of the internal auditory canal posteriorly; skeletonizing the geniculate ganglion, GSPN, and internal carotid artery laterally; and drilling under the Gasserian ganglion anteriorly. This extra-dural petrosectomy allowed for an approach to all lesions from an area posterolateral to the basilar artery near its junction with CN VI, superior to the anterior inferior cerebellar artery (AICA), and lateral to the origin of CN V. Retraction of V3 during this approach allowed avoidance of the region involving CN IV and the superior cerebellar artery (SCA).

**Results:**
Eight pediatric patients (5 girls and 3 boys, mean age of 13.2 ± 4.6 years) with hemorrhagic cavernomas involving the lateral pons were treated utilizing the above surgical approach. Seven cavernomas were completely resected. In the eighth patient, a second peripheral lesion was not resected with the primary lesion. One patient had a transient CN VI palsy, and 2 patients had transient trigeminal hypoesthesia/dysesthesia. One patient experienced a cerebrospinal fluid leak that was successfully treated by oversewing the wound.

**Conclusion:**
The extended middle fossa approach can be used for resection of lateral pontine hemorrhagic cavernomas with minimal morbidity in the pediatric population.

**Development of Intrathecal Riluzole: A New Route of Administration for the Treatment of Amyotrophic Lateral Sclerosis Patients.**

Keifer OP, Gutierrez J, Federici T, Peterson B, Bartus R, Betourne A, Boulis NM.

***Boulis, Nicholas, MD***

**Introduction:**
Oral administration of riluzole is the only Food and Drug Administration-approved therapy for amyotrophic lateral sclerosis. However, per os riluzole therapy has shown modest efficacy and is limited by its negative impact on liver function. We hypothesize that intrathecal (IT) administration of riluzole will significantly improve drug efficacy by increasing local concentrations at targeted spinal cord segments, while circumventing peripheral toxicity.

**Methods:**
A programmable infusion pump (SynchroMed II) connected to an IT catheter (Ascenda) was implanted into Mongrel dogs to deliver a newly developed riluzole formulation. Group 1 (n = 6) received a chronic infusion of riluzole intrathecally (itRIL) following a dose-escalation scheme to delineate drug dose-range tolerability. A control group (n = 4) received riluzole orally at human equivalent dose (b.i.d.; 1.3 mg/kg). The animals were monitored for signs of toxicity using behavioral testing and neurological evaluations. Drug levels in plasma, cerebrospinal fluid and nervous tissue were analyzed by LC-MS. In a second study (group 2, n= 4), we assessed the safety of combined administration of itRIL (0.2mg/h) with oral administration. Finally, we conducted a 6-weeks GLP study in 42 dogs to evaluate the safety and toxicity of a continuous itRIL infusion in combination with oral administration of riluzole for 42 days, including a 14 days recovery period.

**Results:**
The dose-escalation analysis of continuous itRIL infusion demonstrated that the formulation could be safely administered at a dose of up to 0.25mg/h daily for 5 days. Plasma bioanalysis showed that riluzole plasma levels increase linearly with dose during IT delivery but reduced by a 20-fold factor at the max IT dose tested in comparison with the control group. Analysis of nervous tissues showed that the IT route provides a 10-fold increase of riluzole concentrations in the spinal cord compared with the control group. Group 2 results revealed that continuous itRIL infusion paired with oral administration at human equivalent dose was well tolerated in the canine.

**Conclusion:**
Our results indicate that riluzole can be safely administered IT to provide higher drug levels in the spinal cord tissue while maintaining lower plasmatic levels, thereby circumventing peripheral side effects associated with the oral form. Preliminary safety report from our GLP study will be presented at the meeting.

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**Emerging safety of intramedullary transplantation of human neural stem cells in cervical and thoracic spinal cord injury**

***Levi, Allan, MD, PhD***

Levi AD1, Okonkwo D2, Park P3, Jenkins A4, Kurpad S5, Parr A6, Ganju A7, Aarabi B8, Kim D9, Casha S10, Fehlings M11, Anderson KD1, Gage A12, Hsieh J12, Huhn S12, Curt A13, Guzman R14

1Department of Neurological Surgery and the Miami Project to Cure Paralysis, University of Miami MILLER School of Medicine, Miami, Florida, USA, 2Department of Neurosurgery, University of Pittsburgh, PA, USA; 3University of Michigan, MI, USA; 4Icahn School of Medicine at Mount Sinai, Department of Neurosurgery, NY, USA, 5Medical College of Wisconsin, WI, USA, 6University of Minnesota, MN, USA, 7Northwestern University, Chicago, IL, USA; 8University of Maryland, MD, USA; 9University of Texas Health Science Center,, TX, USA, 10Department of Clinical Neurosciences and the Hotchkiss Brain Institute, University of Calgary, Calgary, Alberta, Canada; 11Department of Neurosurgery, University Health Network, University of Toronto, Toronto, Ontario, Canada; 12Stem Cells Inc, Newark, CA, USA; 13Spinal Cord Injury Unit, Balgrist University Hospital, Zürich, Switzerland; 14Department of Neurosurgery, University Hospital Basel, Basel, Switzerland.

**Background:**
Human central nervous system stem cells (HuCNS-SC) are multi-potent adult stem cells with successful engraftment, migration, and region-appropriate differentiation after spinal cord injury (SCI).

**Objectives:**
To present data on the surgical safety profile and feasibility of multiple intramedullary peri-lesional injections of HuCNS-SC after SCI.

**Methods:**
Intramedullary free-hand (manual) transplantation of HuCNS-SC cells was performed in subjects with thoracic (n=12) and cervical (n=17) complete and sensory incomplete chronic traumatic SCI.

**Results:**
Intramedullary stem cell transplantation needle times (INT) in the thoracic cohort (20 M HuCNS-SC) were 19:30 minutes and total injection time (TIT) was 42:15 minutes. The cervical cohort I (n=6), demonstrated that escalating doses of HuCNS-SC up to 40 M range were well tolerated. In cohort 2 (40 M, n=11), the INT and TIT time was 26:05 + 1:08 mins and 58:14 + 4:06 mins,

respectively. In the first year after injection, there were 4 serious adverse events (SAEs) in 4 of the 12 thoracic subjects and 15 SAEs in 9 of the 17 cervical patients. No safety concerns were considered related to the cells or the manual intramedullary injection. Cervical MRIs demonstrated mild increased T2 signal change in 8 of 17 transplanted subjects without motor decrements or emerging neuropathic pain. All T2 signal change resolved by 6-12 months post-transplant.
Conclusion: A total cell dose of 20 M cells via 4 and up to 40 M cells via 8 peri-lesional intramedullary injections after thoracic and cervical SCI respectively proved safe and feasible using a manual injection technique.

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**Hematopoetic Progenitor Cells (HPC) Facilitate Bone Marrow Chemoprotection enabling TMZ/ O6BG Dose Escalation resulting in Improved Survival Andrew**

***Sloan, Andrew, MD***

**Introduction:**
Glioblastoma (GBM) is the most common malignant brain tumor with a median survival of 15 months despite surgery and aggressive radio-chemotherapy. The most important mechanism of TMZ resistance is the O6-methylguanine-DNA methyltransferase (MGMT) gene which repairs temozolamide-induced DNA methylation. The MGMT inhibitor O6-benzylguanine (BG) has demonstrated efficacy in depleting MGMT and maximizing tumor response in early phase clinical trials. However, because MGMT expression is also low in hematopoietic cells, this has resulted in unacceptable bone marrow toxicity, and this approach has been abandoned. We hypothesized that chemoprotection of hematopoietic progenitor cells (HPC) with an MGMT mutant (MGMT-P140K) characterized by normal methyltransferase activity coupled with low affinity for BG, would maximize anti-tumor response while enabling patients to tolerate TMZ & BG dose escalation with minimal toxicity. We thus performed a phase I trial to test this hypothesis.

**Methods:**
We treated 8 consecutive patients with newly diagnosed GBM with standard surgery and radiation, followed by transplantation with autologous CD34+ hematopoetic progenitor cells engineered to express MGMT-P140K using a lentiviral vector in three different arms. To assess chemo-protection, patients' blood counts and transgene marking were monitored during the treatment as was tumor growth and survival.

**Results:**
The viral transduction rates were 2.5-75% and were clearly improved in the third arm with intra-patient dose escalation. P140K-MGMT gene markings in peripheral blood and bone marrow cells increased 3-26-fold with only mild (Grade 2-3) mylosuppression consistent with chemo-selection and chemo-protection as hypothesized. Survival ranged from 20-36 months which exceeded their RPA predicted survival by 1.9-3.2 fold suggesting clinical benefit (mean 2.0). Viral insertion site analysis failed to demonstrate evidence of clonal dominance.

**Conclusion:**
These preliminary result demonstrates that this chemoprotection strategy is tolerable, safe, and enables TMZ & BG dose escalation resulting in increased survival in a small cohort of selected patients. A phase II study is ongoing.

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**External Ventricular Drain Placement in the Angiography Suite Using Real Time Cone Beam CT Navigation**

***Erkman, Kadir, MD***

Current techniques for the placement of external ventricular drains (EVD) involve passing the catheter with a freehand procedure using facial and surface landmarks for trajectory planning. Once the trajectory is chosen, the catheter is passed blindly until spontaneous flow of cerebrospinal fluid is visualized. This technique introduces the inherent risk of misplaced catheters, which has been reported to occur between 10-40% of the time. Misplaced catheters are more common when intracranial pathology results in ventricular shift or altered anatomy.

Cone beam CT capabilities have become mainstream in contemporary angiography suites and allows for 3-dimensional CT scanning. The Philips Xperguide software system has been used in interventional radiology applications for cone beam CT-based navigation within the angiography suite with real time visualization of biopsy needles in the body. This report describes the use of the Philips XPerguide for the placement of external ventricular catheters.
The technique was validated in a phantom skull model prior to use for catheter placement in patients. The AP flatplate detector of a biplane Philip Allura Clarity FD20 system was used. An Xper cone beam CT of the head was performed and used to map the entry and target points on the Xperguide software. Once the trajectory was planned on the software, the AP detector was

moved to the pre-determined plane of axis of the catheter in line with the planned trajectory. With X-ray guidance, the catheter is centered on the entry point and the trajectory is determined by lining the catheter to be perfectly in plane with the frontal detector. This catheter position is held while the angiographic equipment is moved to the pre-determined 90 degree side view location to allow visualization of the catheter as it is advanced. The catheter is advanced and tracked with live fluoroscopy along the pre-planned trajectory until the target is reached.

Through the phantom test runs, it was determined that head flexion is beneficial to allow the trajectory to be along an axis that allows visualization without extreme angles of the angiography equipment. Advantages of this technique included rapid navigation using 3D CT, low radiation doses, real-time tracking of the catheter during placement, and excellent accuracy of the placement of catheters. Standard navigation systems assist with trajectory planning however cannot visualize the catheter as it is advanced, and rely on previously obtained CT scans and registration with the patient's anatomy. The Xperguide system allows for trajectory planning as well as visualization of the catheter allowing identification of kinking or bending of the catheter as it is advanced. In addition, the navigation is based on low-dose cone beam CT obtained on the angiography table. We believe this will allow increased accuracy with EVD placement in a rapid, and low radiation dose system.

## Role of brain hemostatic system in cerebrospinal fluid abnormalities following subarachnoid hemorrhage.

***Britz, Gavin, MD***

**Background And Purpose:**
In 95% of cases subarachnoid hemorrhage (SAH) results in long-term disabilities due to brain morphological changes, the pathogenesis of which remain uncertain. Hindrance of cerebrospinal fluid (CSF) circulation is a possible mechanism interrupting drainage of subarachnoid space and parenchyma of damaging substances. We explored changes in CSF circulation at different time following SAH and a possible role of brain tissue factor (TF, Factor III) in these changes.

**Methods:**
Perforation of circle of Willis was used as a model of SAH in mice. Fluorescent solute (Alexa 594) and 0.02 µm fluorescent microspheres injected into cisterna magna were used to trace CSF flow. Distribution of fluorophores and SAH were scored. Activity of brain tissue factor was blocked by intracerebroventricular administration of specific antibodies. Distribution of TF and fibrin deposition were analyzed using immunohistochemistry.

**Results:**
In sham/naive animals, fluorescent solute and microspheres reached olphactory bulbs within 15-20 min. SAH interrupted CSF flow for up to 30 days. Block of CSF flow did not correlate with the size of hemorrhage. Following the SAH, fibrin was observed on the brain surface including areas without visible presence of blood. Block of astroglia-associated TF increased size of hemorrhage and facilitated spread of fluorophores in sham/naïve animals.
CONCLUSIONS: SAH induces long-lasting block of CSF flow. Brain TF plays an important role in localization of hemorrhage. TF also regulates CSF flow under normal conditions. Targeting of the TF system will allow developing of new therapeutic approaches to the treatment of SAH consequences and pathologies related to CSF flow such as hydrocephalus.

## DRG-Stimulation for the Treatment of Chronic Neuropathic Pain

***Tronnier, Volker, MD***
V.Tronnier, D. Rasche, Department of Neurological Surgery, University of Lübeck, Germany

**Objective:**
Recent advances in the understanding of the role that the Dorsal Root Ganglion (DRG) plays in both the development and maintenance of chronic pain have advanced over the past several years. The DRG is located in the lateral epidural space within the spinal foramen and houses the cell bodies of the primary sensory neurons. It is involved in the transduction of pain to the CNS and exhibits a number of pathophysiologic changes after acute afferent neuronal injury or during chronic pain states as upregulation of pronociceptive cytokines, production of abnormal ion channels and early and late gene changes. Also the pain modulatory role of the surrounding satellite cells have to be taken into consideration. For these reasons and the possible advantage, that this structure is relative resistant to movements, it seemed to be a suitable target for neuromodulation techniques.

**Methods:**
28 Patients (12 female,, 16 male) with an age between 29 and 89 were treated with DRG-stimulation after unsuccessful conservative medical treatment. In 16 of

these patients a CT-guided extraforaminal periradicular injection was performed to evaluate the necessary implantation site. The diagnoses were CRPS I/II (n=10), Intercostal neuralgia (n=4), Postherpetic neuralgia (n=2) and Postherniotomy pain (n=12).

**Results:**
25 of the 28 patients underwent a positive testing trial and were permanently implanted. Finally 8 of 9 patients with CRPS I/II yielded positive long-term results (pain reductioon >50%); 4 of 4 patients with Intercostal Neuralgia and 9 of 12 patients with Postherniotomy Pain. No relief were found in patients with Postherpetic Neuralgia.
Complications: In 8 patients a lead fracture occurred and in three patients a lead dislocation. Three patients needed an additional lead for covering the pain area. The follow-up was more than 3 years.

**Conclusion:**
DRG is a valuable and safe procedure for neuropathioc pain states. We recommend it for CRPS I or two oft he upper limb where spinal cord stimulation can be difficult due to neck movements, for intercostal neuralgia after successful adjacent root blocks due to the segmental overlap and for postherniotomy pain after succesful periradicular infiltrations. Periradicular infiltrations are important in order to determine how many DRG´s have to be stimulated.

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## VariLift-L: An Anatomical Solution to Lumbar Spinal Instability

*Tibbs, Phillip, MD*

**Introduction:**
Lumbar spinal fusion is frequently indicated in the treatment of spondylolisthesis, recurrent disc herniation or adjacent segment disease. Conventional technique includes pedicle fixation with concomitant interbody fusion. The Varilift-L is a revolutionary FDA-approved stand-alone expandable lumbar interbody fusion device, which provides immediate stability and eliminates the need for pedicle fixation. The device is indicated for interbody fusion of the lumbar spine, for spondylolisthesis grade 1 and for up to 2 adjacent levels of the lumbar spine. It can be installed by a Posterior Lumbar Interbody Fusion (PLIF) or Transforaminal Lumbar Interbody Fusion (TLIF) approach, using minimal retraction and no impaction. The device is machined from titanium-alloy, which promotes bony fixation. Its zero-profile design expands from a cylindrical to a wedge shape providing restoration of lordosis superior to other posterior interbody systems. The device restores disc height, foraminal patency and lordosis. The VariLift-L device's large fenestration and hollow graft chamber provides a large fusion surface and resists migration and subsidence. The biomechanics of the device will be illustrated with a video and surgical technique will be discussed in detail.

**Methods:**
This study is a retrospective analysis of 76 patients at the University of Kentucky who underwent Posterior Lumbar Interbody Fusion (PLIF) fixation with the VariLift-L device. The cohort includes 33 females and 43 males, ranging in age from 31 to 91. In these patients, the device was used for single level surgery in 71 patients and for two level surgery in 5 patients. Clinical results have been excellent. VariLift-L has been effective in treating spondylolisthesis with stenosis and instability, in adjacent segment disease, recurrent disc herniation and in the case of scoliosis where pedicle anatomy is difficult. Patient satisfaction, operation time and length of stay for VariLift-L patients will be compared to a cohort of patients who have undergone conventional Posterior Lumbar Interbody Fusion (PLIF).

**Conclusions:**
Clinical outcomes using the VariLift-L technique meet or exceed the benchmarks of traditional lumbar fusion instrumented with pedicle fixation in the metrics of patient satisfaction, length of stay, pain management and return to work. Detailed information and statistical analysis of this large patient cohort will be reported.

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## Single-institution Experience with a Novel Parafascicular Intracerebral Hematoma Evacuation Procedure

*Mitesh, Shah, MD*

**Intro:**
Routine open surgery for spontaneous intracerebral hemorrhage (ICH) has yet to be proven beneficial in spite of multiple clinical trials. The best results are seen in less invasive procedures, suggesting that iatrogenic injury of routine open surgery may offset the benefits of early hematoma evacuation. While tubular retractor systems are well-known, a novel technique combining fascicular anatomy, a navigated trans-sulcal approach and an atraumatic tubular retractor shows early promise of clinical and socioeconomic benefit for this population.
**Methods:**
An IRB-approved, prospective database of all patients who underwent this procedure for acute spontaneous ICH at a single institution was queried. Patients with

concern of an underlying lesion, significant IVH, clots at either extreme of size or who otherwise could not medically tolerate the procedure were not offered intervention. Clinical outcomes, demographics, imaging, and other characteristics were prospectively collected. All patients were treated by a neurosurgeon that had completed the required training course and proctored training period.

**Results:**
21 patients were treated over a 3.3 year period. The mean age was 54 years old; 10 patients were male. ICHs were basal ganglia (16), thalamic (2), and lobar (3); 12 were on the left. The mean time from onset of symptoms to surgical intervention was 24.8 hours. Hematomas had a mean volume of 42 cm3 and a mean depth of 1.7 cm below the cortical surface. Using this procedure, an evacuation of >90% was accomplished in 52%, >75% in 86%, and >50% in 100%. Mean pre-operative GCS improved from 11.2 to 13.4 upon leaving the ICU; the majority demonstrated immediate post-operative improvement. Surgical morbidity included 1 wound infection, and no operative mortalities. There were 3 non-surgical mortalities in the first 90 days for a mortality rate of 14%: two due to severe initial neurologic injury from a giant ICHs, and one at a separate admission from unrelated medical comorbidities. Where available, the 90 day mRS was good (0-3) in 13 of 20, and poor (4-6) in 7 of 20. The mean ICU length of stay (LOS) was 5.8 days; in the subset that did not ultimately have an occult AVM, this lowered to 4.9 days.

**Conclusions:**
Our preliminary experience with this procedure has shown prompt and sustained neurologic improvement and reliable, safe, thorough ICH evacuation in a select cohort of moderately impaired patients with acute spontaneous ICH. Compared to historical controls, the mortality rate is decreased (14% vs. the predicted 26% based on ICH stroke score applied to average cohort characteristics) and the ICU LOS is shortened, suggesting both clinical and clinicoeconomic value to this procedure. This agrees with published single institution data from the Cleveland Clinic and with the pooled preliminary data (from our institution and others). A multicentral prospective randomized clinical trial is currently underway in which we hope to confirm these prospective observational findings.

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## We've Got your Back: How the Nerve Surgeon Can Bail Out the Spine Surgeon

***Zager, Eric, MD***

**Background:**
Nerve surgery has often been considered a peripheral part of traditional neurosurgery, which has been dominated by disorders of the brain and spine. The modern nerve surgeon can assist the spine surgeon not only with challenging differential diagnoses and double crush scenarios, but with nerve transfers following nerve root injury and potentially spinal cord injury.

**Methods:**
The classic foot drop paradigm of L5 root vs. peroneal nerve injury/entrapment is illustrated on annual Board Exams. More challenging differential diagnoses including double crush scenarios will be presented, including C6 radiculopathy and carpal tunnel syndrome, C8 radiculopathy and cubital tunnel syndrome, lower cervical radiculopathies and neurogenic thoracic outlet syndrome (nTOS), simultaneous median and ulnar neuropathy vs. cervical myelopathy or nTOS, and C7 radiculopathy vs. radial nerve palsy or PIN syndrome. Nerve transfers that can rescue the prolonged C5 palsy and brachial neuritis (Parsonage Turner Syndrome) will be demonstrated. Future applications of nerve transfers including amelioration of spinal cord injuries are also being developed.

**Results:**
Typically in double crush presentations, the primary pathology is addressed first, but arguments are made for decompressing the nerve entrapment primarily. Occasionally it is best to address both sites of neural compression simultaneously. The Oberlin transfer for C5 or upper trunk brachial plexus injury has >80% success in restoration of functional elbow flexion. The double nerve transfer for shoulder stabilization and abduction are also quite successful in these cases. Future applications of nerve transfers include extension of upper extremity function in spinal cord injury patients, and potentially implantation of tissue-engineered living nerve grafts into sites of spinal cord injury.

**Conclusions:**
It behooves the spine surgeon to stay abreast of developments in nerve surgery. The collaboration with nerve surgeons is currently quite active, and will only increase in the future.

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**Comparison of pedicle screw types used in Sin, pediatric deformity**

***Sin, Anthony, MD***

**Introduction:**
There are different types of pedicle screws available to use in pediatric deformity cases. Initial correction may vary depending on the pedicle screw design.

**Method:**
Pediatric deformity cases for adolescent idiopathic scoliosis (AIS) were reviewed from prospective database from Shriners Hospital in Shreveport since April 2012. Fives cases were chosen at random into three groups according to the type of screws used to correct the deformity. Immediate post-operative correction was compared.

**Result:**
Over 200 AIS cases were done by a single surgeon since April 2012. Three different types of screws were used from three different manufacturers: multiaxial heads with dual threads, reduction towers, 5.5mm cobalt rods (A), multiaxial/uniaxial heads with reduction towers, 5.5mm cobalt rods (B), monoaxial/multiaxial reduction heads, 6.0mm titanium rods (C). Initial coronal correction of the major curve was the greatest for group C patients: 64% (A), 77% (B), 80% (C). There were no differences in complications related to instrumentations.

**Conclusion:**
Surgeons experience and using more restricted screw heads at the apex were more significant than the manufacturer of the instrumentations in AIS cases.

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**Degenerative Discharthopathy and Lumbar Stenosis with the use of Interspinous Distractors**

***Varsos, Vasileios, MD***
VASILEIOS. G. VARSOS (1), GEORGIOS. V. VARSOS (2)

(1) Department of Neurosurgery, Red Cross Hospital, Athens, Greece; (2) Department of Neurosciences, University of Cambridge, Cambridge, UK

**Purpose:**
The purpose of this study was the illustration of the efficacy of use of interspinous distractors in patients with severe degenerative lumbar stenosis, in general.

**Material:**
In this retrospective study we used interspinous distractors in 163 patients (71 men, 92 women), with lumbar stenosis and we reviewed their history and operative notes. The mean age of the patients was 53,2 years.

Clinical inclusion criteria included 1) resistance to conventional medical treatment; 2) age older than 70 years or, if younger than 70 years, a high operative risk and inability to tolerate lengthy surgery; 3) lumbar stenosis symptoms of greater than moderate severity (i.e. neurogenic intermittent claudication); 4) pain/numbness in flexed lumbar and exacerbation when in extended position and longer than 6 months.

Radiological inclusion criteria included pure lumbar stenosis with spondylolisthesis when exists no more than grade I.

**Method:**
Internal laminectomy (ligamentous flavum) with or without discectomy, was performed in all patients before the introduction of the distractors. 51 patients were fused (PLIF). Mean operative time was about 45 min without PLIF and 70 min in other cases with fusion. 32 patients operated in one level, 78 patients in two levels, 53 in three levels. Clinical evaluation was performed with VAS and ODI in a postop follow-up period of 12 and 18 months. Simultaneous radiological evaluation with plain X-rays and spinal MRI was performed.

**Results:**
The VAS and ODI scores were used as the primary measures at the 12 months control. Mean VAS for low back pain (preop: 7.5, postop 3.5), for leg pains (preop 8.3, postop 3). Mean ODI, preop 55, postop 29. The scores at the 18 months control were a little better, as the greater improvement was noticed the first postop months.

In terms of complications, eight patients (4.9%) revealed postlaminectomy syndrome. Two patients (1.96%) were reconsidered due to PLIF olisthesis. One patient (0.6%) had CSF leak and inflammation.

**Conclusions:**
The surgical treatment of lumbar stenosis with "U" interspinous distractors in a simple and useful technique, which is promising for long life results. The appropriate patient selection and the specification of the cause of lumbar stenosis in the studied group of patients, optimize the surgical plane and lead to the best outcome for these patients.

**Diagnostic Cerebral Angiography for Evaluation of Carotid Stenosis Prior to Treatment**

***Binning, Mandy, MD***

Carotid stenosis is increasingly diagnosed during routine screening as well as part of stroke and transient ischemic attack (TIA) work-up. Non-invasive imaging modalities such as ultrasound, CT angiography or MR angiography are typically the initial screening studies. Many practitioners feel comfortable proceeding with endarterectomy based on non-invasive imaging alone. In our practice, all patients with high-grade (≥80%) asymptomatic or ≥50% symptomatic stenosis who may be candidates for treatment undergo cerebral digital subtraction angiography (DSA) prior to treatment to better evaluate the true degree of stenosis as well as the most appropriate treatment modality. We performed a retrospective review of 25 procedures in 23 patients with carotid (2 bilateral) stenosis to evaluate if DSA changed our management. Twenty-one carotid stenoses were symptomatic, 4 asymptomatic. All patients were found to have a degree of carotid stenosis based on non-invasive imaging that would warrant treatment, except one patient who was thought to have a complete carotid occlusion. DSA revealed non-significant stenosis in 7 patients and a string sign in the patient with "occlusion." Most of these patients has heavily, concentrically calcified plaques. DSA changed our management in 8 (32%) of carotid arteries. This small retrospective review suggests that DSA may be warranted prior to treatment of carotid stenosis, especially in patients with heavily calcified plaques. This is currently in the process becoming a multi-center retrospective study.

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**Predictors of local control of post-stereotactic radiosurgery brain lesions treated with laser interstitial thermal ablation**

***Prabhu, Sujit, MD***

Authors: Dhiego Bastos, MD, Vivek Beechar, MD, Ganesh Rao, MD, David Fuentes, PhD, Jason Stafford, MD, Jeffrey Weinberg, MD, Jing Li, MD, Komal Shah, MD and Sujit Prabhu, MD

**Introduction:**
MRI guided Laser Interstitial Thermal Therapy (MRgLITT) is a minimally invasive technique used to treat recurrent lesions after stereotactic radiosurgery (SRS) including radiation necrosis. Here, we identified factors associated with local control after treatment of recurrent post-SRS lesions with MRgLITT.

**Methods:**
Thirty consecutive patients with 44 lesions who had signs of progressive disease were treated with MRgLITT. Volumetric analysis of pre- and post-treatment lesions was performed and the primary endpoint was local disease progression.

**Results:**
The overall free progression survival time was 22.4 months. The local recurrence rate was 25%. Non-dural-based lesions had a median progression free survival time (PFST) of 24.4 (CI95% 27.7-21.1) months compared to 11.3 (CI95% 17-5.5) months for dural based lesions (p=0.015) The Cox Proportional Hazard Model showed a hazard ratio (HR) for recurrence in dural based lesions of 3.892 (1.185-12.787) (p=0.015). More completely ablated lesions had a PFST of 26.7 (CI95% 29.1-24.2) months compared to 4.5 (CI95% 6.4-2.7) months for incompletely ablated lesions (p<0.001). A completely ablated lesion presented a HR for recurrence of 0.42 (0.009 - 0.203) (p<0,001). A tumor/ablation volume ratio lower than 80% favored a longer PFST (24.3 months (95% CI 27.7-20.0) versus 15.2 (95% CI 23.1-7.4) months, CI 95%). The HR for recurrence in tumor/ablation ratio higher than 80% was 3.588 (1.086 - 11.861) (p=0.036). The volume of the tumor was a predictor of local recurrence with larger tumors (>5cm3) demonstrating a higher rate of local failure (p<0,001). The rate of local recurrence did not correlate with tumor histology. Deviation of the actual trajectory from the planned trajectory did not correlate with local failure. The median target deviation was 2.1mm +/- 1.23mm.

**Conclusion:**
Local control of post-SRS lesions treated with LITT is dependent upon location (dural versus non dural), pre-treatment lesion size, and completeness of ablation. Smaller lesions with more complete tumor coverage demonstrated durable local control. Tumor/ablation ratio can be used to predict local recurrence. LITT demonstrated excellent safety and accuracy in deep lesions and is a good alternative to treat progressive disease after SRS for brain metastasis.

THE SOCIETY OF UNIVERSITY NEUROSURGEONS

# BYLAWS

OF

THE SOCIETY OF UNIVERSITY NEUROSURGEONS, INC

## ARTICLE I

NAME AND OBJECT

Section 1. This organization shall be known as "The Society of University Neurosurgeons, Incorporated."

Section 2.

The objectives of this Society shall be: to promote scientific and social discourse among its members, to encourage investigative work in the neurological sciences, to improve teaching methods and techniques in neurological surgery, and to inspire its members to acquire humanistic ideals and to achieve clinical excellence in the practice of medicine."

Vision:

To enhance academic neurosurgeons throughout the world and improve the state of clinical and laboratory neuroscience globally

Mission:

a)To improve the exchange of new ideas and scientific disclosures,

b)To enhance comprehension of global activities, university settings, and specific regional challenges in the academic sector, and

c) To mentor and direct emerging academic neurosurgeons during the mid-career period.

Section 3. No part of the income or property of this Society shall inure to the benefit of any Individual.

## ARTICLE II

MEMBERSHIP QUALIFICATIONS

Section 1. The membership of the Society shall be divided into four classes:

(a) Active

(b) Senior

(d) Honorary

(e) Inactive

A member shall be elected as provided in Article V- CANDIDATES FOR MEMBERSHIP.

Section 2. Classification of Membership

(a) ACTIVE. Active members shall be neurological surgeons who are certified by the governing body in their respective countries, and who are engaged in the practice of neurological surgery and/or substantially engaged in research on neurological surgery.

(b) SENIOR. An Active member may, upon request to and approval of the Executive Council, transfer to Senior membership upon attaining the age of sixty-five (65) years or upon retirement from practice of neurological surgery, whichever comes first. Senior members may not vote or hold office (except for the office of Historian), but may serve on Committees; and are not required to pay dues or regularly attend annual meetings.

(c) HONORARY. Honorary members shall be chosen as recognized leaders in the field of neurological sciences. They shall not exceed five (5) in number at any given time. They shall not be required to pay dues or attend annual meetings. They shall not vote or hold office but may serve on committees.

(d) INACTIVE. Inactive members shall be former Active members who by virtue of illness or other reasons can no longer maintain Active membership and are not eligible for any other classification of membership. An Active member may, upon request to and approval of the Executive Council, transfer to Inactive status. An Inactive member may be restored to Active status by request to and approval of the Executive Council. Inactive members shall not vote, hold office, or serve on Committees. They shall not be required to pay dues or attend annual meetings.

Section 3. Qualifications for Membership

The Membership Committee shall be cognizant of the objectives of the Society and shallrecommend for membership individuals who are affiliated with a medical school or outstanding group practice. If an Active member ceases to comply with the membership requirements as provided in Section 2(a), he/she must resign from the Society or be transferred to a different membership classification. Individual exception to this rule requires recommendation by the Executive Council and approval by majority vote of the Active membership.

Section 4. Limitation of Membership

The number of Active members in the Society may be limited upon recommendation of The Executive Council and approval by a majority vote of the Active membership.

## ARTICLE III

OFFICERS

Section 1. The officers of the Society shall be President, President Elect, Vice-President, andSecretary/Treasurer. The Executive Council shall be composed of the officers, one Active Member-at-Large appointed by the President, and the Immediate Past-President of the Society.

Section 2. The Nominating Committee shall present a slate of proposed officers to be elected for the succeeding year at each annual meeting. Active members present at the meeting may make additional nominations. Election of officers shall be by ballot; the member receiving the largest number of votes cast for that office shall be elected. Officers so elected shall take office at the close of that annual meeting.

Section 3. Vacancy of an office shall be filled by an appointee of the Executive Council.

Section 4. The President shall serve for a term of one (1) year. He/She shall preside at all meetings and decide all questions of order, appoint committees, and cast the deciding vote in ties.

Section 5. The President Elect shall be elected at each annual meeting. He/She shall become President of the Society at the close of the subsequent annual meeting.

Section 6. The Vice-President shall assist the President. He/She shall preside at functions andmeetings in the absence of the President.

Section 7. The Secretary/Treasurer shall serve for a term of three (3) years. The Executive Council shall determine at which year the election for Secretary/Treasurer will be held. He/She shall keep records of attendance and minutes of each meeting, read all correspondence to the Society, handle all notices and correspondence of the Society. He/She shall account for the finances of the Society, and collect dues and notify members of delinquent standing. He/She shall receive all applications for membership or guest attendance and forward this information to the Membership Committee at least one (1) month prior to the annual meeting.

Section 8. The Executive Council shall be the governing body of the Society and have charge of activities of the Society not otherwise provided in these Bylaws. The Executive Council shall work in close coordination with the Membership Committee concerning the proposal of candidates for membership in the Society.

Section 9. The Historian of the Society shall maintain and update the Society of University yearbooks, which should document the scientific and social programs of the yearlymeeting.

## ARTICLE IV

MEETINGS

Section 1. The Society shall meet annually in the Spring or early Summer at a site determined by the Future Sites Committee.

Section 2. The annual meeting shall be a three (3)-day scientific program that includes a weekend. The scientific presentations shall be balanced between clinical and investigative topics.

Section 3. The Chairman of the Program Committee shall serve as Host for the annual meeting, assisted by his/her Committee, and will be responsible for arrangements of both social and scientific activities during the meeting.

Section 4. Robert's Rules of Order (Revised) shall govern the conduct of the business meetings of the Society and the duties of its officers. The order of business shall consist of a roll call, reading of minutes, reading of correspondences, old business, new business, election of new members, reports of committees, the Secretary/Treasurer's report, election of officers, appointment of committees, and adjournment.

Section 5. Members of any class shall be assessed a pro rata share of the expenses of the annual meetings which they attend.

## ARTICLE V

CANDIDATES FOR MEMBERSHIP

Section 1. Candidates for membership shall have the qualifications as provided in Articles 1, 2, & 3.

Section 2. No candidate shall be elected to Active membership who has not attended at least two annual meetings as a guest, and presented a scientific paper during at least one of those meetings.

Section 3. Each candidate shall be nominated in writing by a minimum of two (2) Active members to the Secretary/Treasurer at least two (2) months prior to the next annual meeting. The nomination shall include the candidate's curriculum vitae and a statement of his/her present academic and professional status. The completed proposal for membership shall be forwarded to the Membership Committee for consideration. The Membership Committee shall present to the Executive Council their recommendations for new members. On approval of the Executive Council, candidates shall be proposed to the Active Membership by written secret ballot at the annual meeting of the Society. Election of a member requires an affirmative vote of three-fourths (3/4) of the Active members present and voting at the annual meeting.

Section 4. The Membership Committee shall present no more than ten (10) candidates for active membership each year with no requirement of a minimum number to be presented.

Section 5. The Secretary/Treasurer shall notify each candidate elected to membership not earlier than two (2) weeks following the date of his/her election.

Section 6. A candidate who has failed to be elected may be reconsidered at subsequent annual meeting upon written request of three (3) Active members to the Executive Council.

ARTICLE VI

DUES

Section 1. All Active members of the Society shall be assessed annual dues, the amount to bedetermined each year by the Executive Council.

Section 2. Dues are payable in advance for the succeeding year at the time of or immediatelyfollowing the annual meeting, at the discretion of the Secretary/Treasurer.

## ARTICLE VII

STATUS OF MEMBERS

Section 1. To maintain membership in good standing, members of all classes must fully abide by the Bylaws of the Society.

Section 2. An Active member shall be suspended when dues or assessments have not been paid for the previous two (2) years. If he/she fails to attend two (2) consecutive annual meetingsand does not present an excuse acceptable to the Executive Council, a warning letter will be sent. If an active member fails to attend three (3) consecutive meetings, then his/her membership will be terminated. Termination on the grounds of non-payment or failure to attend does not require a vote of the Active membership.

Section 3. A member may be suspended or dropped from any class of membership in the Society by an affirmative vote of three-fourths (3/4) of the Active membership.

## ARTICLE VIII

COMMITTEES

Section 1. The Society may have standing and ad hoc committees as determined by the President and the Executive Council. There shall be at least six (6) standing committees: Membership Committee, Nominating Committee, Bylaws Committee, Future Sites Committee, Program Committee, and Senior Advisory Committee.

Section 2. The Membership Committee shall be composed of three (3) members, one (1) to be elected at large each year to serve a term of three (3) years. The senior member of the Committee shall serve as Chairman. This Committee shall review nominations for new members and present the applications of the most worthy and desirable candidates to the Executive Council. The names of the candidates approved by the Executive Council shall be submitted to a vote by the Active membership at the next annual meeting of the Society.

Section 3. The Executive Council shall serve as the Nominating Committee, with the Immediate Past-President of the Society as Chairman. The duties of the Council shall include the yearly nomination of: President-Elect (1), Vice President (1), Member-at-Large (1), as well as new Members to the following Committees: Membership (1), Future Sites (1), Bylaws (1), and Senior Advisory (1-2).

Section 4. The President taking office at the close of the annual meeting shall appoint the Program Committee for the upcoming year. The new President is an automatic member of the Program Committee. The Chairman of the Committee shall be the Host for the nextannual meeting. The Program Committee may invite guests to complement the scientific program of the meeting.

Section 5. The Future Sites Committee shall be composed of three (3) members, one to be elected at large each year to serve a term of three (3) years. The senior member of the Committee shall serve as Chairman. This Committee shall recommend the site

of future meetings at least two (2) years in advance.

Section 6. The Bylaws Committee shall make recommendations to the Executive Committee by proposing amendments to the bylaws, rules, and regulations. The Bylaws Committee will be composed of three (3) members, each serving a term of up to three (3) years. Recommendations so approved will then be voted upon by the Membership via email ballot or at the Annual Meeting.

Section 7. The Senior Advisory Committee shall make recommendations to the Executive Committee for maintaining the Vision and Mission of the Organization. Senior Advisory Committee members will be able to attend Executive Committee meetings. This Committee will be composed of three (3) to six (6) members, each serving a term of up to three (3) years.

## ARTICLE IX

GUESTS

Section 1. The Society shall encourage the presence of guests at its annual meeting.

Section 2. Certain invited guests of the Society shall not pay a registration fee or be charged for a share of the group expenses of the meeting. Such guests shall include individuals approved by the Executive Council.

Section 3. Individual guests to the annual meeting may be invited by members. The member shall notify the Secretary/Treasurer of the name and address of his/her proposed guest, and the Secretary/Treasurer shall officially invite the guest to the meeting.

## ARTICLE X

AMENDMENTS

Section 1. Amendments to these Bylaws may be proposed in writing by a member of the Executive Council at any time. The amendment shall be voted on at the subsequent annual meeting. The Secretary/Treasurer shall notify all Active members in writing of the proposed amendment prior to the annual meeting, and such amendment shall require for adoption an affirmative vote of three-fourths (3/4) of the Active members present and voting.

Section 2. Amendments to the Bylaws and voting procedures may also be conducted by email. The Secretary will notify members by email of the need to vote on an Amendment to the Bylaws, permitting fourteen (14) days for voting. Such proposed amendments shall require for adoption an affirmative vote of three quarters (3/4) of the Active Members responding.

RULES AND REGULATIONS

Of THE SOCIETY OF UNIVERSITY NEUROSURGEONS, INC.

SUBJECT 1

MEMBERSHIP

Section 1. Candidate Profile

(a) Candidates should be committed to an academic career.

(b) Candidates should have sufficient publications that the quality of their academic activity can be evaluated.

(c) Candidates should have attended a SUN meeting, presented a paper before the Society, and expressed an interest in the Society.

(d) It is desirable to consider Candidates who have potential for hosting a future SUN meeting.

Section 2. Membership Process

(a) Candidates must have attended at least one (1) SUN meeting and presented at least one (1) paper to the Society before being recommended for membership.

(b) No voting for membership will occur at the first meeting that the candidate attends as a guest and at which he/she presents a paper to the Society.

(c) The membership process shall be initiated by proposal of the name of the Candidate to the Secretary/Treasurer by two (2) Active members. The candidate shall then complete the membership application form and submit it to the Secretary/Treasurer.

(d) After documentation of the completeness of an application for membership, the Secretary/Treasurer shall forward it to the Chair of the Membership Committee for consideration.

(e) The candidate is proposed for membership to the Membership Committee and a recommendation is made to the Executive Committee based on the candidate's profile.

(f) At the next regular meeting of the Society, the candidate is brought forward for a vote during the Business Meeting.

(g) If elected by the membership, the candidate will be invited to membership and upon joining the Society, is then eligible to attend the next regular meeting.

# Exhibitors

Penumbra

Zeiss

Medtronic